THE MODEL ENGINEER

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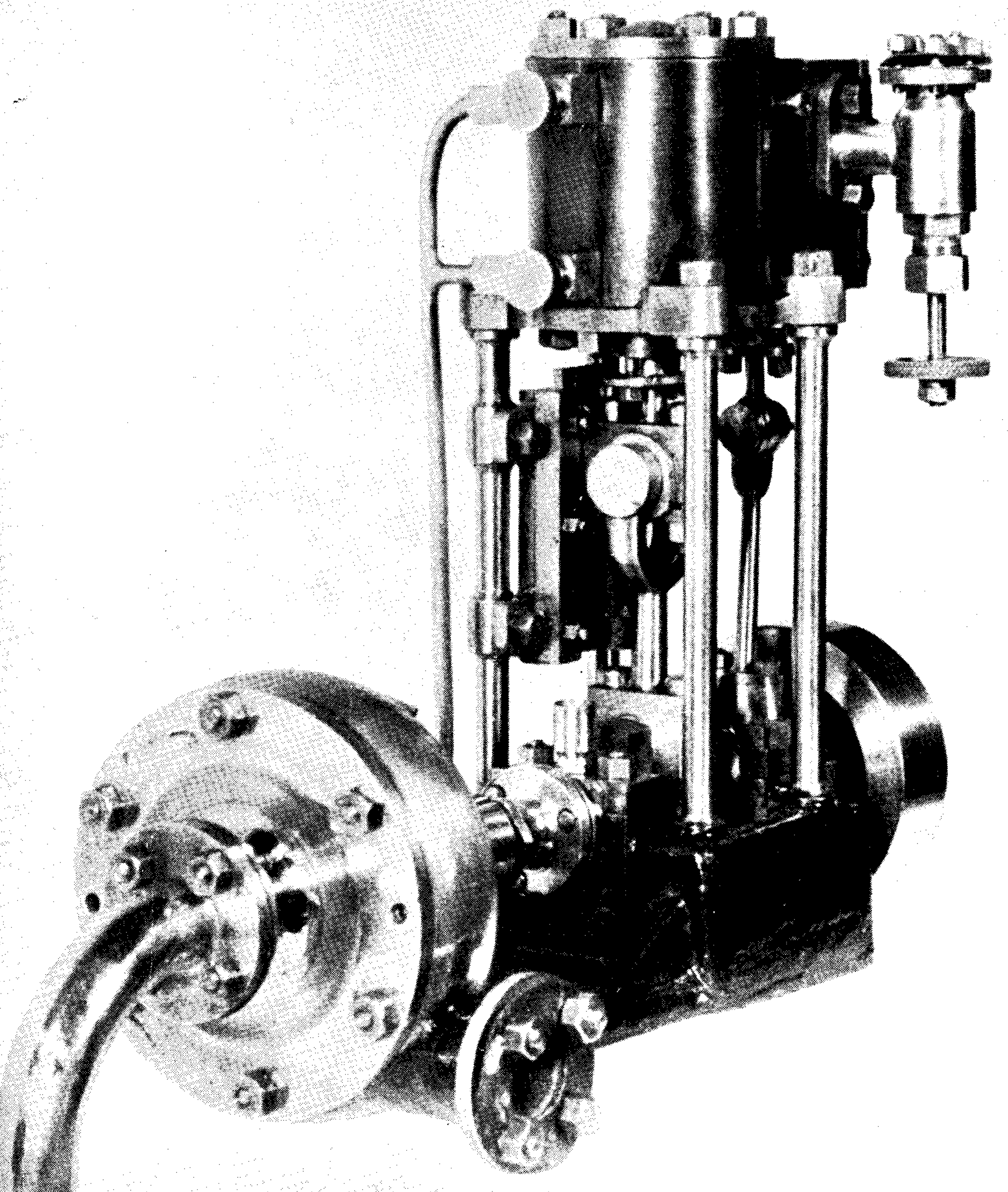


The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST., LONDON, W.C.2

17TH NOVEMBER, 1949 VOL. 101 NO. 2530

SMOKE RINGS

Our Cover Picture

● BETWEEN APRIL 10th and June 12th, 1947, we published a complete description of a Tandem Condensing Mill Engine built by a contributor who signed himself "Crank Head." At that time, the engine for driving the circulating pump had not been made, but has since been completed together with the pump, and is seen in the picture reproduced on our cover this week. As will be seen, it is a model which is rather out-of-the-ordinary, and we hope that, in due course, we may be able to publish a full description of it.

Models in Schools

● WE WERE interested to learn, recently, that because children seem able to remember what they see better than what they hear, Essex schools have introduced a kind of loan-service of models which not only illustrate a large variety of different objects but also tend to infuse more liveliness into lessons.

This scheme is intended to cover about two hundred schools in the Mid and North Essex Division. An experienced organiser will collect materials, make and mount models and, as the scheme develops, vans will be used for delivering and collecting them.

The teaching profession has always recognised and appreciated the value of models as an aid to learning; but the Essex scheme is the first of its kind to come to our notice, and we think it is almost certain to be a success, more especially in the remoter districts where models are not easily found.

The A. & P. Tram Engine

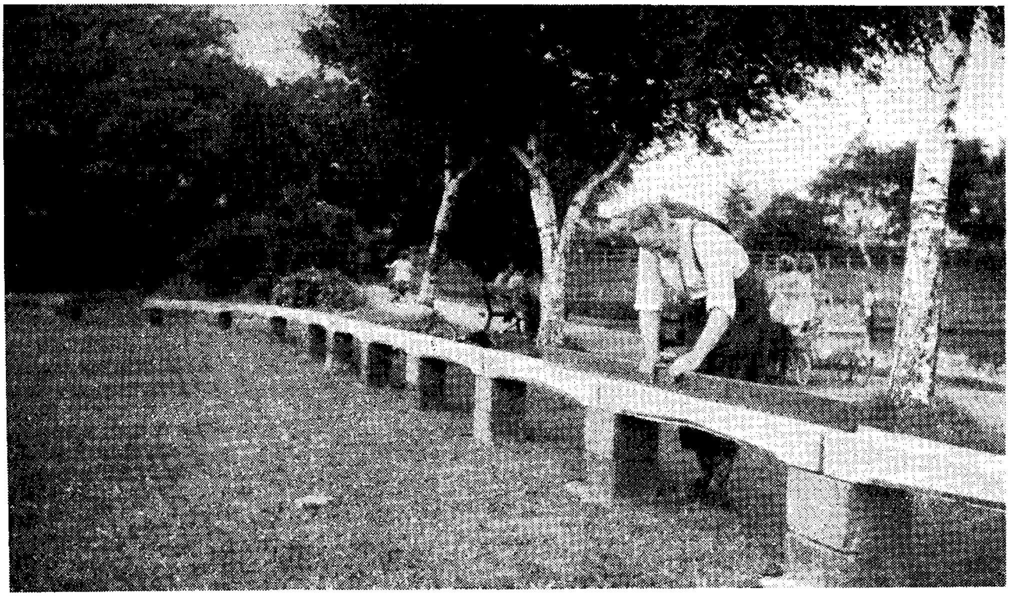
● MR. WARREN HALLUM, 1099 Sixteenth Avenue West, Albany, Oregon, U.S.A. in the course of an interesting letter on the subject of English traction engines, mentions that his reading and research indicate that Aveling & Porter built a number of traction-type tram engines. One of these is mentioned in a paper on "The History of the Steam Tram," published in the May-June 1937 issue of *The Journal of the Institution of Locomotive Engineers*, and an illustration depicting its external appearance is included.

Mr. Hallum wonders if it is possible to obtain any drawings of this particular type of engine, or something like it. The manner in which the engine was geared to the driving-wheels is obscure, though Mr. Hallum is aware that, in some cases, a form of chain-drive was used.

If any reader knows of any drawings of the A. & P. tram engine, perhaps he would be kind enough to let us know, or communicate direct with Mr. Hallum, whose address is given above.

Model Marine Power Units

● THERE IS a rather regrettable tendency at the present time for builders of model power boats to take the line of least resistance in the matter of power equipment, and the result is often the fitting of an installation of a type quite out of character with the craft itself. This tendency has been noted in several otherwise fine prototype boats which have been entered in model engineering exhibitions, some of which were of outstanding quality in respect of the design and workmanship of the hull, superstructure and deck fittings, but all impressions of realism were completely lost on looking into the engine room. Nowadays, there are many small power plants available ready-made, some of which are light, compact and very efficient, and there is a strong temptation for the hull constructor to side-track any problems in the provision of an effective power plant by fitting one of these engines. By doing so, however, the value of the model as an authentic reproduction of the prototype is very much reduced, and the constructor tacitly admits that he regards the power plant simply and solely as a means to an end, rather than as an integral and cohesive part of the design. The excuse is often made that the constructor of the hull and exterior fittings lacks the facilities necessary for the construction of an engine, but in many cases, it is quite evident that if the problem were tackled with the same ingenuity as exercised in other details of construction, these difficulties could be, at least partially, overcome. It may be noted that the successful model power boats in the "M.E." Exhibition are almost invariably an harmonic combination of good design and craftsmanship in both the engine and the hull, and that in prototype competitions organised by model power boat clubs, not only are these factors taken into account, but also seaworthiness, control and general effect under working conditions.



The New Track at Carlisle

● ONE OF several locomotive tracks which have been under construction during the past season is the one at Carlisle. Mr. J. V. Milburn, hon. secretary of the Carlisle and District Model Engineering Society, when sending us the photograph reproduced herewith, states that the track has been completed and is giving much satisfaction. It is situated in Upperby Park, Carlisle, and is a continuous track of 200 yards circuit; at present, it has 5-in. and $3\frac{1}{2}$-in. gauges available, but the society intends to add $2\frac{1}{2}$-in. gauge later on.

As will be seen, the foundation consists of a series of concrete arches, and the photograph was taken while some of these were being tested for level. There are two sidings 18 ft. long and a turntable 11 ft. long. The rails are of high-duty alloy, which were purchased from the British Aluminium Co.; they are laid on pitch-pine sleepers, with strips of damp-course under each sleeper. On test, the track was found to give very smooth riding.

At the moment of writing, there are seven $3\frac{1}{2}$-in. gauge locomotives available; but another seven are being built, three for 5-in. gauge.

The Carlisle Corporation gave the land and financed this scheme, and the society provided the labour and some of the material. Mr. Milburn thinks that there are other locomotive builders in the area who would be glad of an opportunity of using the track, and he will be very pleased to supply details to anyone writing to him at 51, Marks Avenue, Raffles, Carlisle.

A Small Fret-Saw

Suitable for Wood or Metal

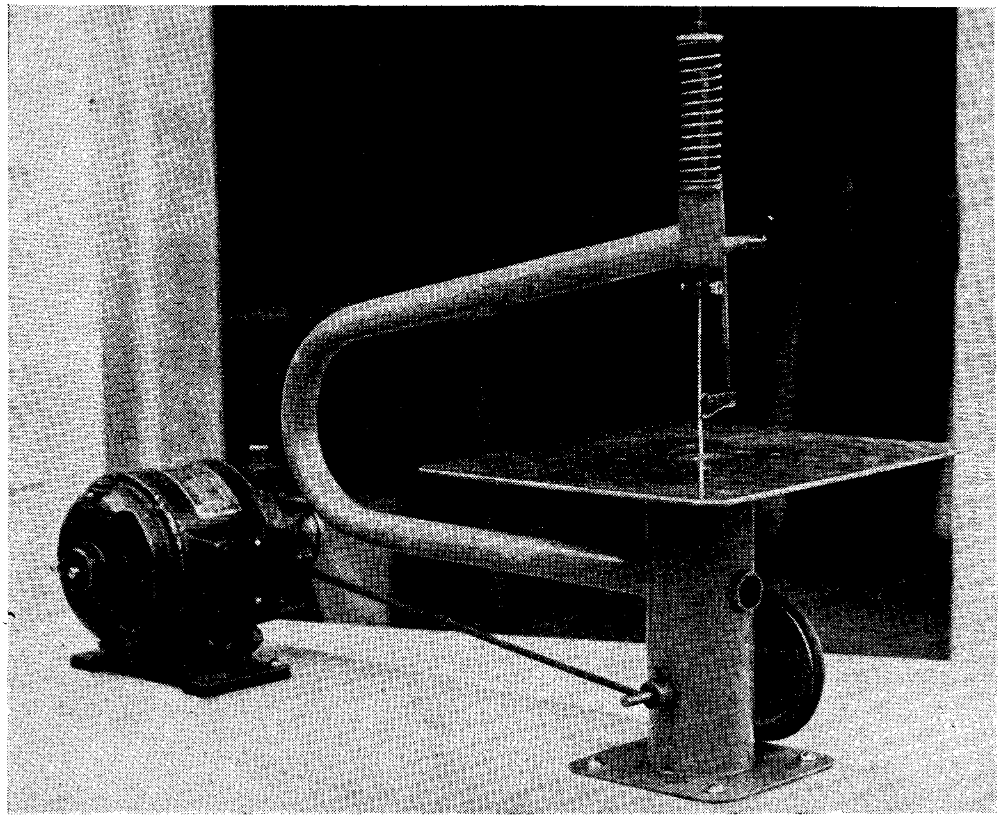
by A. Kruck (Switzerland)

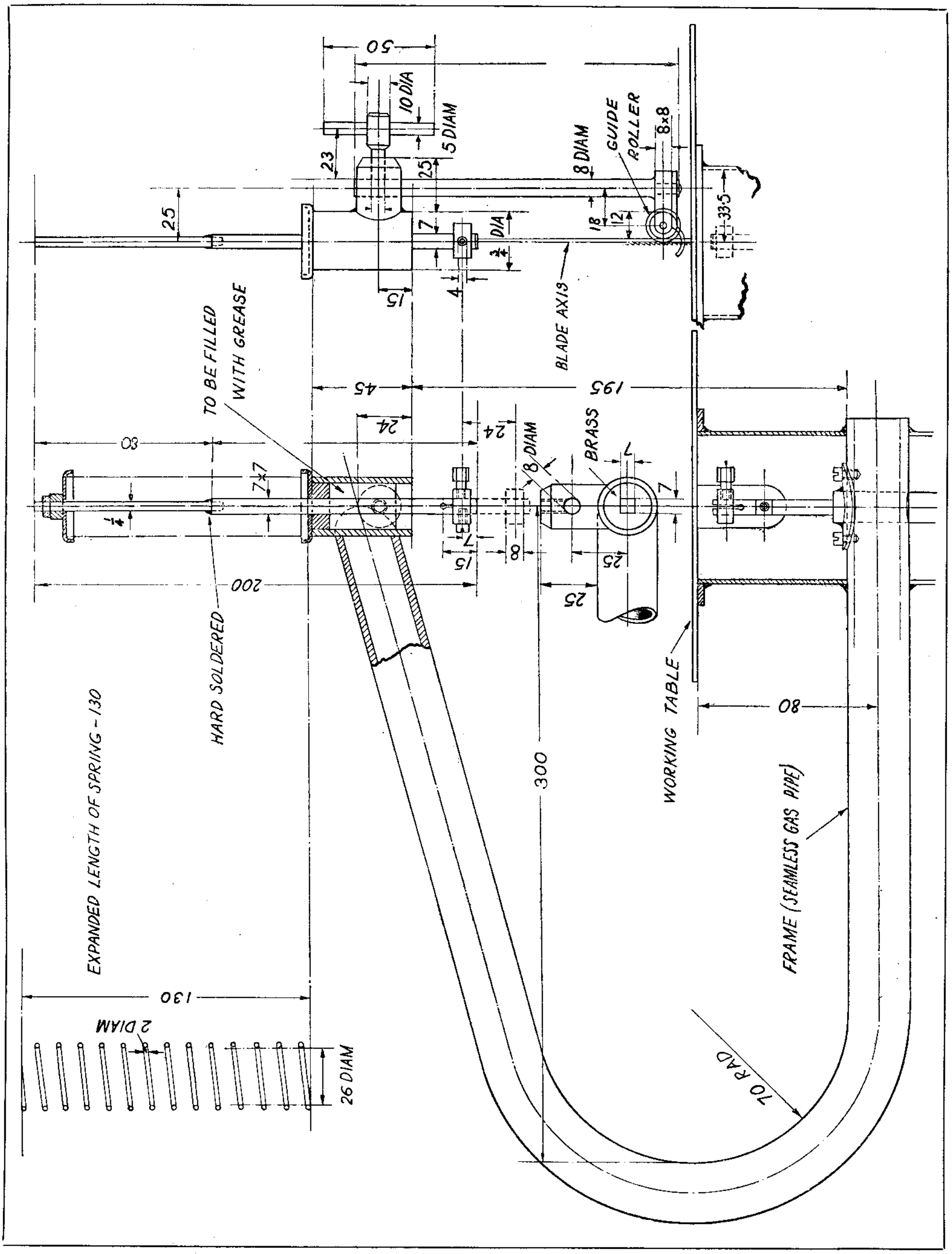
THE small fret-saw described below was built by me for a friend, whose hobby is building model boats for exhibitions. For certain good reasons my friend did not wish to buy any of the saws of this type commercially available; first, because the length of cut of these saws is limited to about 1 ft., and secondly, because these saws are only supplied complete with electric motor and are, therefore, rather expensive. As it was, my friend possessed a suitable motor; and as regards maximum length of cut, the sidewise arrangement of the frame, as chosen for the home-built saw, permits an unlimited length of cut.

At that time, my workshop equipment was rather limited. All I had was a small bench lathe of 55 mm. swing and 160 mm. between centres, together with a hard-soldering outfit, and the usual hand tools.

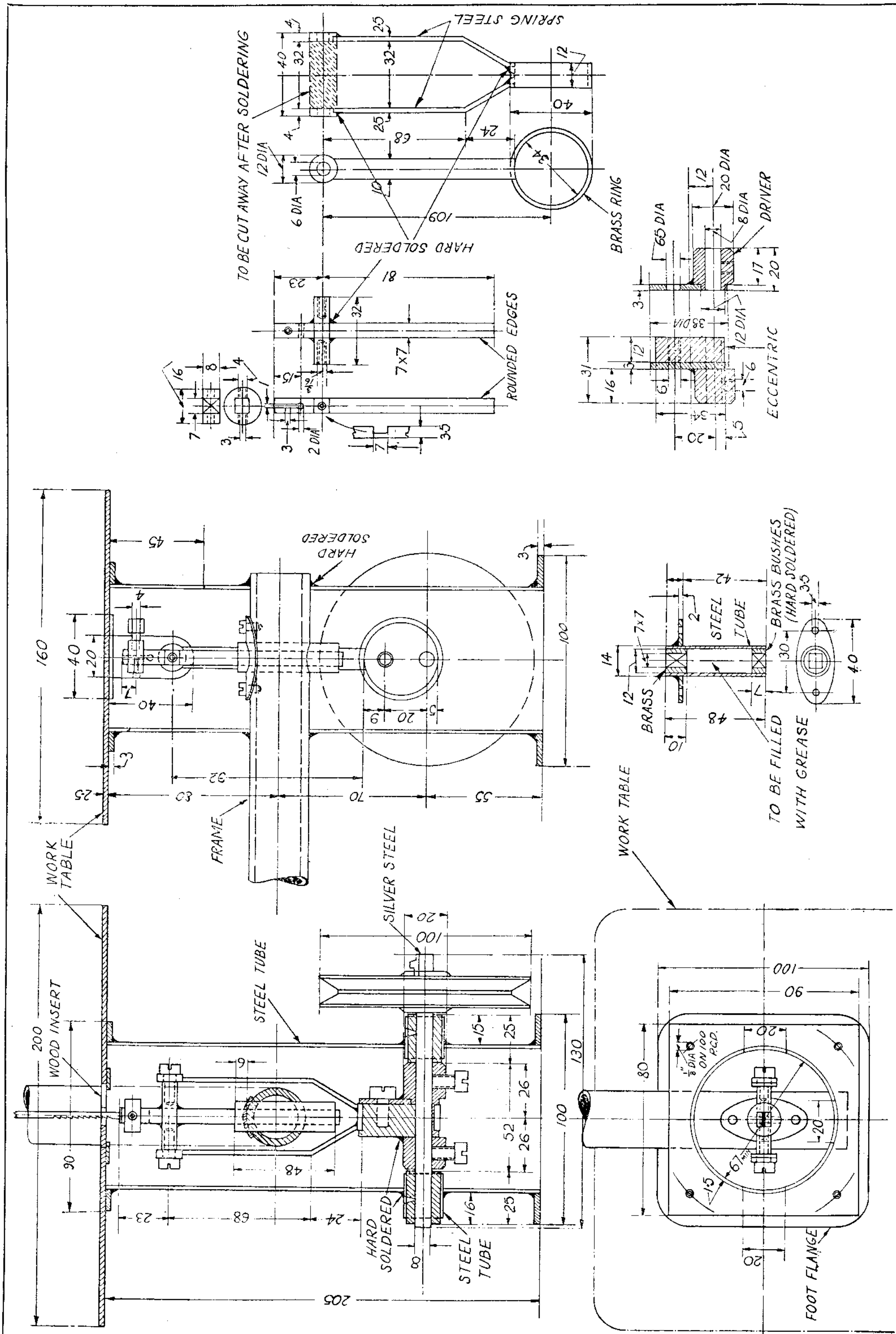
All details of the saw are shown in the various drawings reproduced, and I will therefore confine myself to mentioning a few points liable to prove difficult for beginners. As regards the combined stand and table support, which is made of a piece of 70 mm. diameter tubing, the limited available distance between lathe centres forced me to carry out its machining in the manner outlined in the sketch. The drilled holes for the frame and for the bearings of the driving shaft were finished to a tight fit with a hand file. After this, both table plate and foot flange were attached to the tube by hard-soldering.

The bending of the frame, made of $\frac{3}{4}$-in. gas pipe caused some difficulty, and it was found necessary, to fill the pipe with fine sand, and then to bend it in the manner indicated in the sketch. The bending had to be done very slowly and with great care. Before the frame could be attached

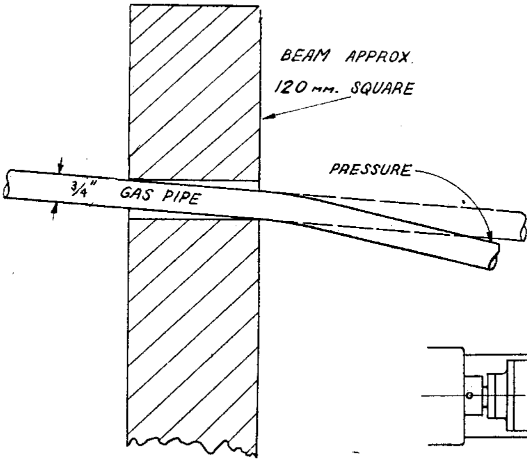




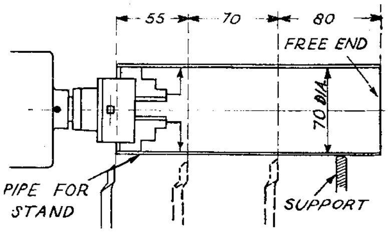
to the stand by hard-soldering, it was necessary to drill the hole for the bush guiding the eccentric-rod. Care had to be taken to drill this hole exactly perpendicular with the lower horizontal leg of the frame. The manner in which this operation was carried out is outlined in the sketch. The two small holes for attaching the flange of the guide-sleeve were drilled at the same time. The sketch also shows how the bore for taking the upper grip could be located by turning round the tailstock. Before attaching the frame by soldering, it is most important to see that the upper



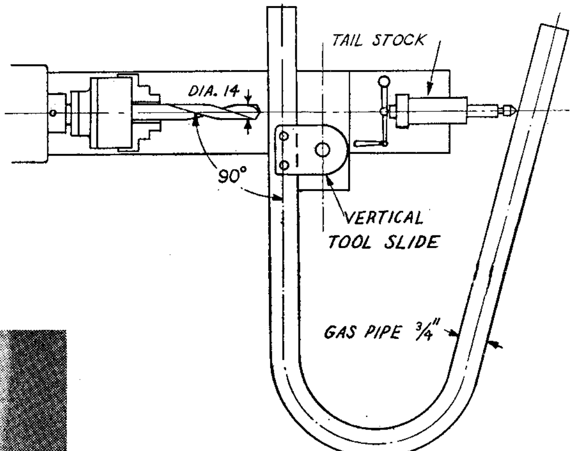
TO BE CUT AWAY AFTER SOLDERING
SPRING STEEL
HARD SOLDERED
12 DIA
6 DIA
BRASS RING
ROUNDED EDGES
7x7
2 DIA
65 DIA
20 DIA
8 DIA
DRIVER
38 DIA
12 DIA
ECCENTRIC
HARD SOLDERED
FRAME
WORK TABLE
BRASS
STEEL TUBE
BRASS BUSHES (HARD SOLDERED)
TO BE FILLED WITH GREASE
WORK TABLE
WOOD INSERT
STEEL TUBE
SILVER STEEL
HARD SOLDERED
STEEL TUBE
1/8" DIA ON 100 P.C.D.
FOOT FLANGE



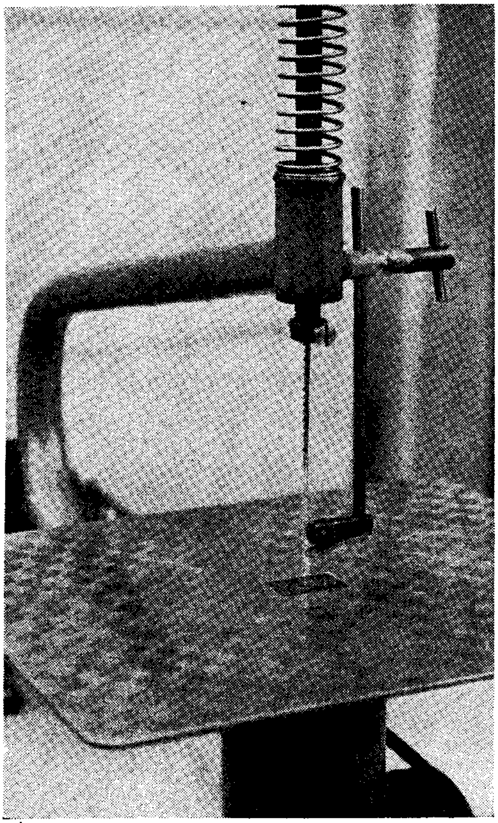
How the frame is bent



Machining the stand



Drilling the frame



Close-up of the saw and working table

and lower blade guides are properly trued up. In order to make sure that the saw blade would be perpendicular with respect to the table of the machine, I pushed a 7 mm. square rod through the two guides, and then made the lower soldered joint first, and after that the upper soldered joint, thus precluding any shifting of the pieces. The housings for the two bearings of the driving shaft are made of 16/18 mm. tubing. In order to achieve respective alignment, a round bar of 16 mm. diameter was pushed through the bearings when making the soldered joint with the stand.

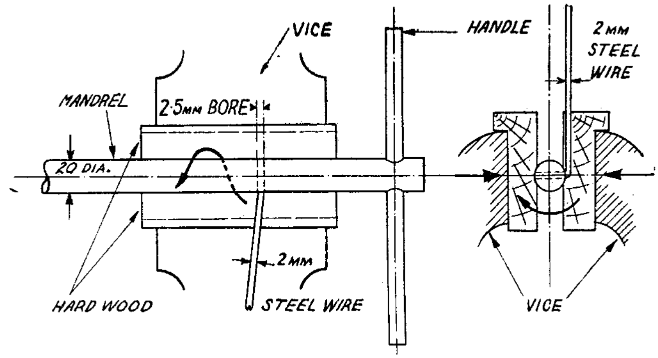
A helical spring of the type required is difficult to buy ; and I therefore made the spring myself from 2 mm. wire in the manner indicated in the sketch.

I should mention that the actual size of the table of the machine is 280 × 250 mm. and not 200 × 160 mm. as shown in the drawing. With regard to the guide roll for guiding the saw blade, care must be taken to properly line up the holder of the guide roll.

A motor of 1/5 horsepower is sufficient to drive the saw when cutting wood of up to 30 mm. thickness ; while a motor of approx. 1/12 horsepower suffices for wood of 6 mm. thickness. The speed of the pulley can be chosen as 900-1,000 r.p.m. If suitable saw blades are used, the machine can serve for cutting brass and iron sheet up to 0.8 mm. thickness ; but in this case the speed of the

saw should be reduced to one-half of that given on p. 626. When inserting a saw blade, of which a sufficient number should be kept in stock, care must be taken to true it up properly; also, the guide roller must not be allowed to exert any pressure upon the blade, but must touch its back only slightly; otherwise the blade would be bent. By mounting the machine on a board as shown in the photograph, it can be easily clamped to the work bench. A hole should be cut in the board for the removal of the chips.

It took me 56 hours to build the saw, apart from the time spent on preparing the drawings.



Making the coiled spring

The Billericay Exhibition

THE preponderance of the model railway subject has come to be the recognised thing at most model exhibitions up and down the country; or more correctly, it has returned to its former place in the hearts of modelmakers despite electrification, dieselisation and nationalisation, and a wealth of good models, nearly all the work of club members was displayed. The centrepiece was a 2-rail 4 mm. layout measuring 12 ft. by 8 ft. 6 in. complete with double-platform station, swing bridge, canal and lock gates, harbour complete with train ferry (based on the one at Harwich) not forgetting a section of a small town, all accurately modelled. The layout was constructed in six panels, and more than one operator can work at a time. One item that caught the writer's eye was a 4-mm. coke-oven engine which looked very realistic in the gas works which formed part of the layout; it certainly looked as though it could be shunted under the belly of a dachshund!

On a side table was the Club Championship Cup, won by Mr. S. R. Kemp with his excellent 4-mm., 2-rail U.S.A. "Austerity," which was shown with other locomotives and examples of various coaching stock, all his work and to the same high standard. A 3-in. gauge two-cylinder 0-6-0 saddle tank chassis by Mr. R. Dukes, and a complete L.N.E.R. Pacific by Mr. J. F. Hatch, to ½-in. scale, also a 5-in. gauge "Sandringham" chassis and tender by Mr. Henderson represented the larger models. This activity by club members will bear fruit when the club's outdoor track situated near the swimming pool is completed. It will accommodate 5-in., 3½-in. and 2½-in. gauges; we are informed that work is more than half done. The overall dimensions are 160 ft. by 120 ft. with an extended straight along one side.

Model Ships

The model ship has a very strong following in Billericay. On the stage of the hall was set out a model harbour, the work of Mr. P. E. Selby, it was a complete panorama of shipping modelled to the scale of 25 ft. to 1 in., and the ships ranged from H.M.S. *Vanguard* to "Thames" class submarines and coastal motor boats. Also, there were timber ships, a collier and an oil tanker.

On the side tables were many examples of vessels of all kinds. Outstanding were two canal barges (monkey type) and a motor canal barge by W. Nutt, junior. These waterline models were to ¼-in. to 1 ft. scale, the detail work, including the gay colouring of the prototypes, was faithfully reproduced. The same remarks apply to the converted sailing barge to 4-mm. scale, full model by the same builder.

A model of the *Penang* driven by a single-sided turbine suitably geared, the work of Mr. Richman, senior, and a model of the paddle steamer *Royal Sovereign* have both given a good account of themselves on the local lake.

A working demonstration model of the feathering gear and paddle-wheel of a pleasure steamer caused a great deal of interest.

Deservedly in a room by itself, was the now famous model of Billericay as it was in 1934. It is to 2-mm. scale and is so complete and realistic that it is all too easy to imagine oneself flying over the town at about 700 ft. It measures 15 ft. by 6 ft. at the widest end. Also displayed was a model of Bullsted Farm and Billericay Post Mill to 4-mm. scale. Mr. Richman, junior, had also collected and displayed a wealth of old records and items of local interest which gave full point to various houses depicted in his main model.

General Engineering Models

A selection of stationary engines, driven by compressed air, was demonstrated, including an undertype engine and boiler and an horizontal engine, a compound marine engine and a self-contained vertical engine and boiler in brass by the late Mr. Simpson.

A display model of a modern machine shop by Mr. Richman, senior, formed part of a collection of ancient and modern machine-tool models.

Both Chelmsford and Southend clubs lent exhibits which gave added weight to an already fine show for which the organisers are to be congratulated.—C.B.M.

The French International Regatta

Run at le Vesinet, near Paris

Messrs. J. L. Chevrot, G. Stone, P. Chevrot and G. M. Suzor

WE have received the following report from Mons. Suzor of the Modele Yacht Club de Paris.

On September 11th, at le Vesinet, a charming spot near Paris, we held our international meeting of power boats, officially controlled and recorded by the officers of the Federation Francaise Motonautique.

The reward was a cup generously offered by the French Ford Cie, to the fastest boat out of all classes; this means 10-, 15- and 30-c.c. were running against each other.

The run was five laps of 100 metres, say 500 metres, and the length of the bridle was of 4 ft. (American regulation) instead of 24 in. (English) and we had no silencer nor stopping device.

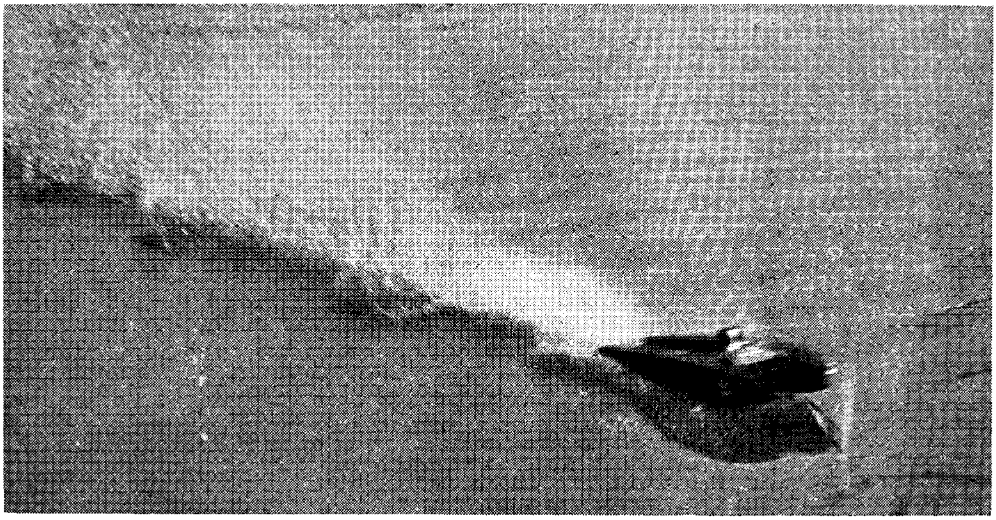
The weather was very nice and the racing began in the morning with the 30-c.c. boats. Unfortunately for them, the running area was highly disturbed by a kind of return wave which kept capsizing all the boats, and the result was a comparatively slow average speed.

Moving the pole some yards farther, we continued the race with the 10-c.c. craft but the effect of the return wave coming from the border was nearly as bad as before. Once again, all competitors were annoyed by capsizing and, to the consternation of everybody, one of Mr. Stone's two boats (*Rodney*) was definitely out of competition, as the engine was completely ruined; the cylinder exploded, con.-rod bent, etc. . . . .

It was impossible to continue under these conditions, then after the lunch interval, it was decided to put the pole in quite a different part of the lake, and the first runs showed us that it was a great improvement; in fact, we began with a very good race.

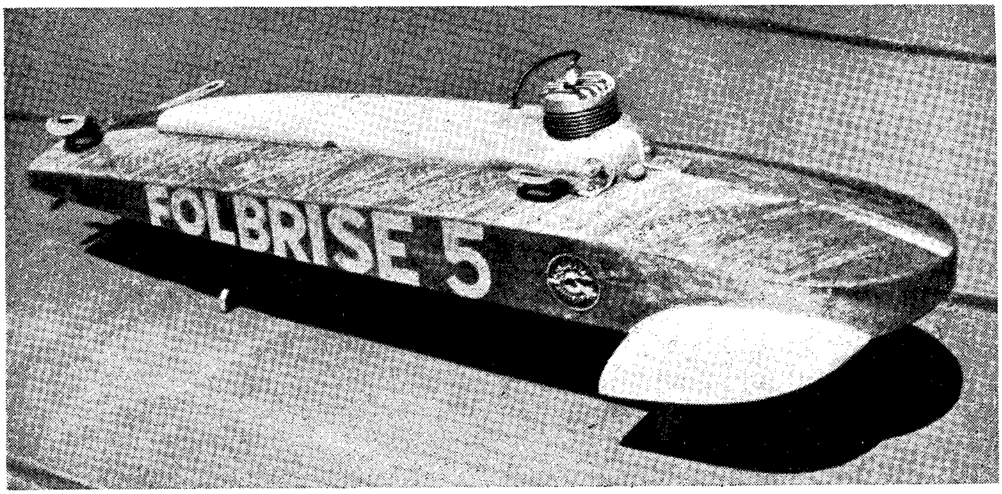
The favourite of the day, as he was some weeks before at Geneva, was George Stone. I know Mr. Stone and his work. He is a charming fellow and a clever model engineer, and his boats are of outstanding workmanship. The prognostic was true . . . he reached the best speed of the meeting.

The results were :—



"Rodney" at high speed

			k.p.h.	m.p.h.
1st	Stone, George (England)	*Lady Babs II*	101.022	62.780
2nd	Chevrot, Jean Louis (Suisse) ..	*Folbrise* 5	86.500	53.760
3rd	Devauze, Jean (France)	*Vano*	84.906	52.760
4th	Jonet, Robert	*Eole*	81.100	
5th	Chevrot, Pierre	*Be-Bop II*	76.300	
6th	Mahieu, Maurice	*Flying Pontoon* (30-*c.c.*)	74.280	
7th	Suzor, Gems	*Nickie* 8 (30-*c.c.*)	73.770	
8th	Durand, Jacques	*Vega*	60.800	
9th	Guillin Guyot, Claude	*Pennard*	60.000	



M. J. L. Chevrot's 10-*c.c. Hornet-engined "Folbrise* 5*" (Switzerland) which won second place in the Paris International Regatta*

Funnily enough, each of the nations present took one of the three first places.

The fastest was powered by an American Dooling 10-c.c., glow-plug fired; the next two boats were powered by French 10-c.c. commercial engines (R.E.A. and Vega 10-c.c.) also glow-plug fired and whereas the other 10-c.c. were Hornet-powered and Hornet magneto-fired, the 30-c.c. were home-made 4-stroke engines and magneto equipped.

The conclusion gathered from the Parisian and Geneva meeting is :—

(1) It is possible to organise a successful regatta open exclusively to racing hydroplanes; both of these regattas held the spectators interest throughout the day.

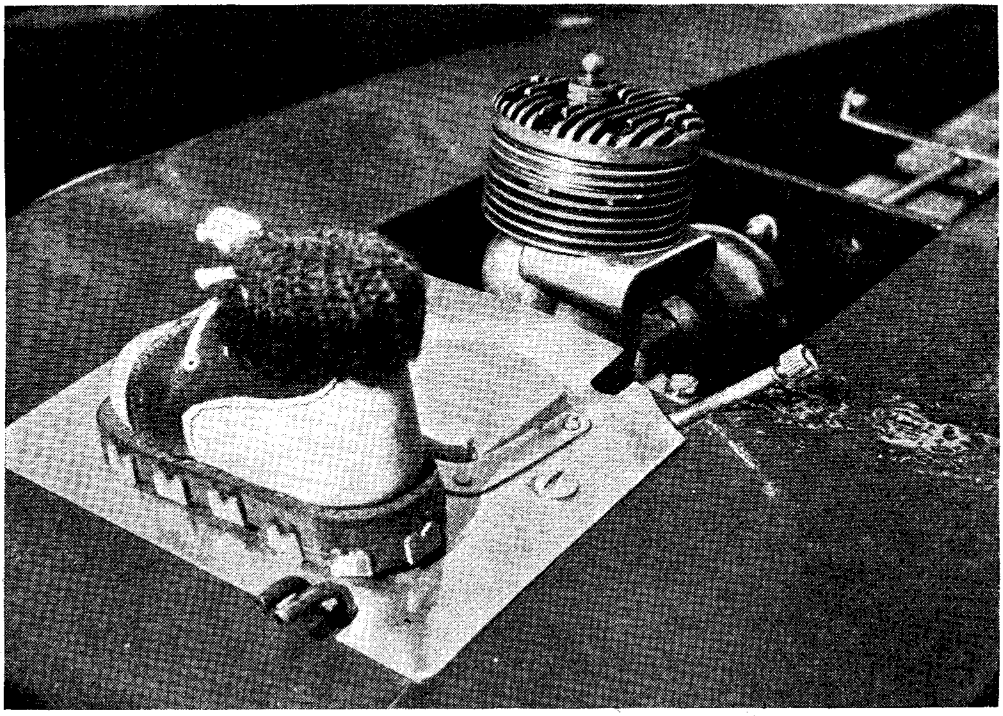
(2) A suitable pond makes the number of successful contestants much higher, to the spectators satisfaction.

(3) The bridle of 4 ft. is definitely much more convenient than the 24 in. one, as it avoids a lot of bad starts.

(4) It is interesting to note that in Geneva, out of 12 recorded contestants the best speed was 70.800 m.p.h. while the lowest was of 47.172 m.p.h. In Paris the best was of 62.780 m.p.h. and the lowest 37.290 m.p.h.

We must remember that this last speed was often the highest obtained at other regattas held on less suitable ponds. In fact, we have never seen so many real speed boats in action at any previous international meetings.

M. Devauze (France) with his 10-c.c. Hornet-engined "Vano" which won third place



The lucky shoe mascot on "Lady Babs II"

IN THE WORKSHOP

by "Duplex"

50—Fitting a Saddle Index to the Lathe

WHERE it is required to turn one or more shoulders on a shaft mounted in the lathe, and these shoulders have to be located at an exact distance from the end of the work or in relation to one another, this distance can be readily determined in thousandths of an inch by reference to the leadscrew index.

Moreover, as the leadscrew has a pitch of, say, $\frac{1}{8}$ in., each full turn of the index will, of course, mean that the tool had advanced $\frac{1}{8}$ in. along the work. When, however, long traverses are taken with the saddle, it is all too easy to make a mistake in counting the number of turns made by the leadscrew; and drawing marks on the work, or measuring the distance traversed by applying a rule to the rotating work or to the moving saddle are not altogether satisfactory alternatives.

If the lathe is regarded as a measuring machine, or a dividing engine as it is termed, it is in its manner of working essentially similar to the ordinary micrometer, for the leadscrew index then represents the thousandth inch graduations on the micrometer thimble, and the leadscrew itself the feed screw of the micrometer. What the lathe lacks, however, is the graduations on the micrometer sleeve indicating complete turns of its feedscrew.

To make good this deficiency, it was decided to fit a scale to the lathe bed, whereby a direct reading of the saddle movement could be readily made. It is, of course, essential that this scale should be mounted so that it can be easily set to correspond with the leadscrew index and thus enable the two sets of graduations to be used in conjunction with one another.

The photographs Figs. 1 and 2 illustrate how this scale has been fitted to the Myford M.L.7 and Myford-Drummond lathes respectively.

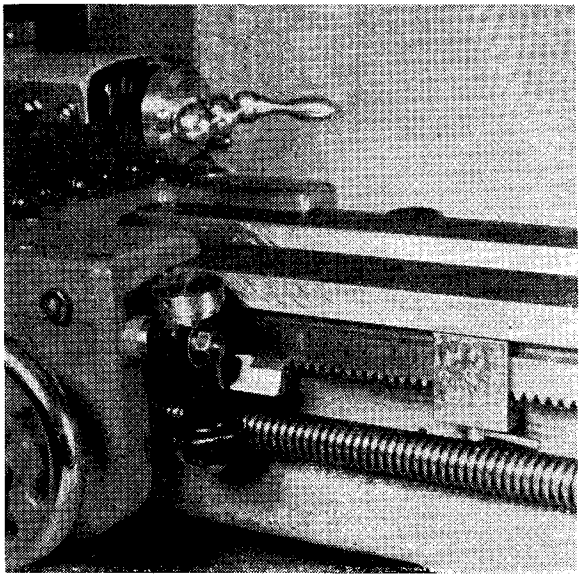


Fig. 1. Saddle index fitted to the Myford lathe

As will be apparent, the actual scale is fixed to a carriage, which slides on the bed rack and is secured to it in any required position by means of a clamping-screw fitted with a short handle. If the thumb is applied to the face of the carriage, and the clamp handle is manipulated with the tip of the index finger, the scale can be readily moved and set where wanted by using the right hand only.

To enable the scale to be used, an index of some kind must be attached to the saddle and so placed that it can be easily read during turning operations.

The index fitted to the M.L.7 lathe can be seen in Fig. 1, and its appearance when detached from the saddle is illustrated in Fig. 3. In the present case, the modified form of thread indicator, previously described, is fitted, and the hanger carrying the index plate replaces the standard fibre washers and is thus secured in position when the thread indicator clamp-nut is tightened.

It will be seen that the position of the index plate can be adjusted by rotating either the hexagon spindle or the hanger itself, and in this way the index can be set to lie close to the edge of the scale to enable readings to be easily taken.

The index of the Myford-Drummond attachment, seen in Fig. 2, is fixed to the short leadscrew chip-guard which is attached to the rear face of the saddle apron. The bar to which the chip-guard is secured is, here, slotted to allow the index to be adjusted in relation to the scale.

In the two attachments illustrated, it will be seen that a portion of a commercial rule has been used for the $\frac{1}{8}$ in. scale, and although the actual numerals are of little account as the inch and fractional inch graduations are what matters, nevertheless, these temporary scales will be replaced later by others specially made for the

purpose by a machining process to be described in a future article.

Using the Saddle Index

Now that the main constructional features of the saddle index have been described, a practical but simple example of its method of use may be cited. Let us suppose that a shaft, mounted in the lathe, has to be reduced in diameter to form a shoulder precisely 1.525 in. from its end. First, with the leadscrew nut engaged, the leadscrew is turned to bring its index to the zero position; the clamp-screw of the saddle index scale is then loosened and the carriage is moved along the rack to bring an inch mark on the scale into line with its index. The lathe is now started and the end of the shaft is faced by using the *topslide* and cross-slide feeds only. The tool is then withdrawn from the work by turning the leadscrew, with the knowledge that the tool will again start to cut as soon as the zero position of the saddle is passed with the automatic feed in operation. It now remains to engage the mandrel drive to the leadscrew and to watch the saddle index line as it travels along the scale; as it approaches the $1\frac{1}{2}$ in. mark, the attention is transferred to the leadscrew index. If a convenient form of disengaging gear is fitted in the mandrel drive to the leadscrew, this should be actuated when the leadscrew index has reached a reading some 5 thousandths of an inch short of the final figure, which is 25 thousandths to make up the full amount of 1.525 in. The exact distance required to complete the turning operation is then obtained by turning the leadscrew by hand.

Should a second shoulder have to be turned at a precise distance from the first, this can be readily done by adding the additional distance to the previous measurement and taking readings from the saddle and leadscrew indexes accordingly.

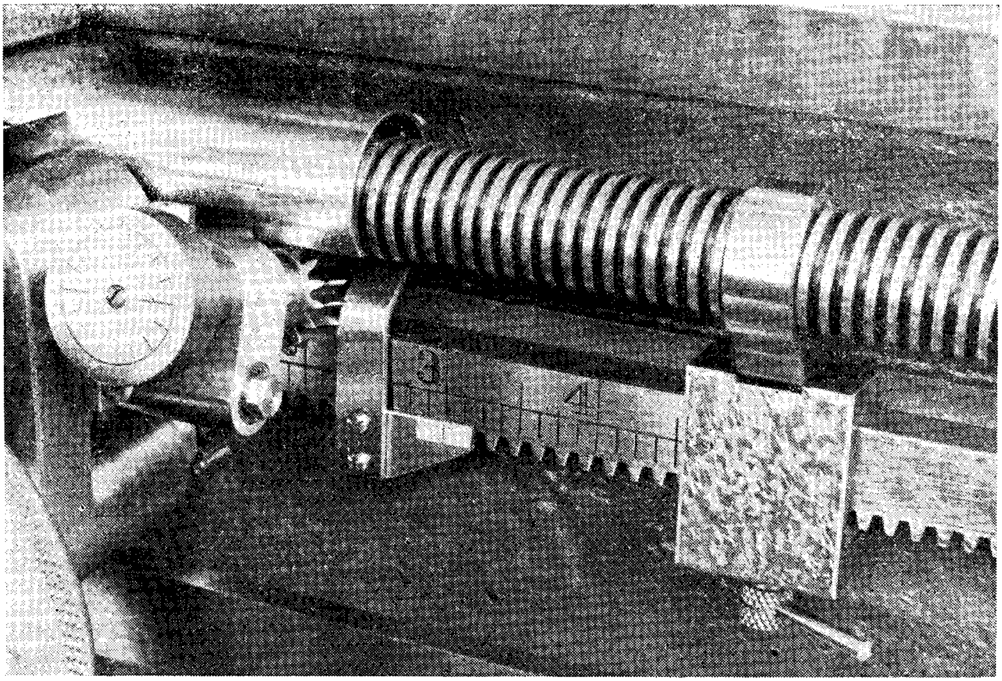


Fig. 2. The saddle index for the Drummond lathe

By using this form of saddle index in conjunction with a reliable leadscrew disengaging gear, these operations can be carried out extremely quickly and with but little danger of mistakes being made.

Furthermore, when boring blind holes, the tool can, with the aid of the saddle index, be entered for an exact distance, so that not only is it quite easy to machine a bore to any precise length, but also there should then be no danger of the tool being fed in too far and possibly damaged by being jammed against the bottom of the bore.

Constructing the Attachment

As shown in the photograph, Fig. 3, the index member consists of three main parts: a vertical hanger (1), a hexagon carrier bar (2), and an index plate (3). The working drawings for these components are given in Fig. 4.

When making a short, tapered part like the

hanger, first mark out the position of the holes, and from these centre-punch marks scribe the circles indicating the outline of the ends.

Join these circles with scribed lines to denote the width of the part, and mark the radiused portions with a dotting punch. Next, the work is filed to shape and its edges are draw-

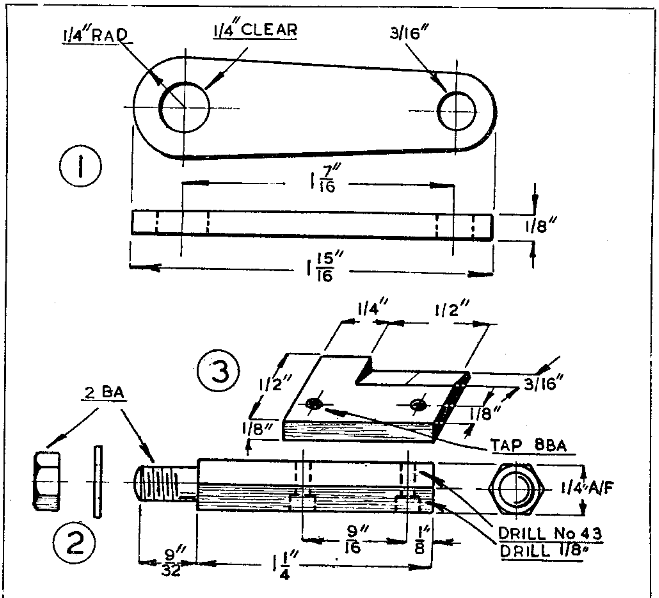


Fig. 4. *The index hanger, plate and bar*

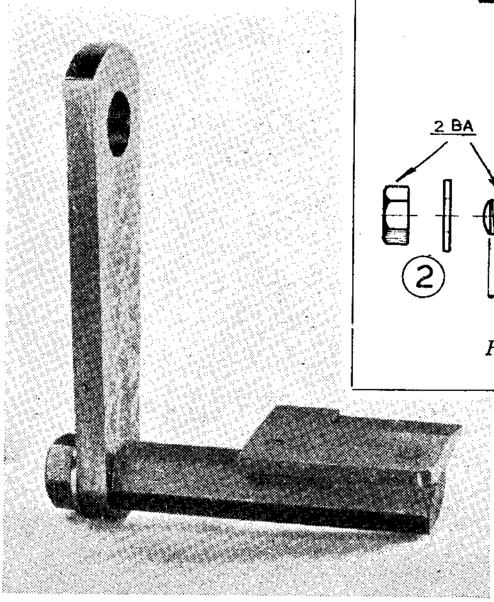


Fig. 3. *The scale index*

filed to give a good finish. To raise the work above the level of the vice jaws, and to prevent it tipping, it should be supported on a block when the two side faces are filed flat by plying a fine file in the direction of the long axis of the part.

If a piece of 4 B.A. nut-size hexagon rod is used to make the bar (2), one of the flats can be employed as a bolting face for the index plate, and the opposite flat can then readily be marked out for the holes to receive the attachment screws ; moreover, material of this form can be gripped in the self-centring chuck when turning the portion which fits into the hanger.

Alternatively, a piece of square-section rod may be used for this part or a length of round rod on which a flat is formed. The end of the bar must be made a turning fit in the hanger to allow of adjustment when assembling the index.

Finally, the bar is gripped in the machine vice and drilled and recessed to receive the two 8-B.A. screws which secure the index plate in position.

The index plate (3) is made from a piece of mild-steel strip which is gripped in the machine vice, attached to the vertical slide, to enable the bevelled face to be formed by means of an end-mill or a fly-cutter. Before the work is removed from the vice, the lathe mandrel is locked and a V-pointed tool, mounted in the four-jaw chuck, is employed to cut the index line. By this means, the line will be accurately cut and will have a constant width and depth throughout its length.

One screw-hole can now be drilled and tapped to enable the plate to be attached to the bar, and when the parts have been further secured by

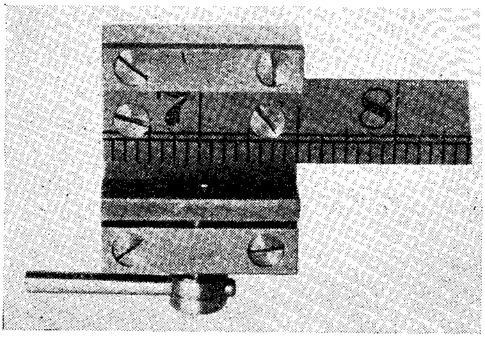


Fig. 5. *Rear view of the scale carriage*

being gripped in a toolmakers' clamp, the second screw-hole is drilled from the guide hole in the bar.

To complete the work on the index plate, it is cut to length and its surface and edges are finished by careful filing with a fine file.

The Scale

A view of the carriage with its rule, as seen from behind, is shown in the photograph Fig. 5 and the working drawings are given in Fig. 6.

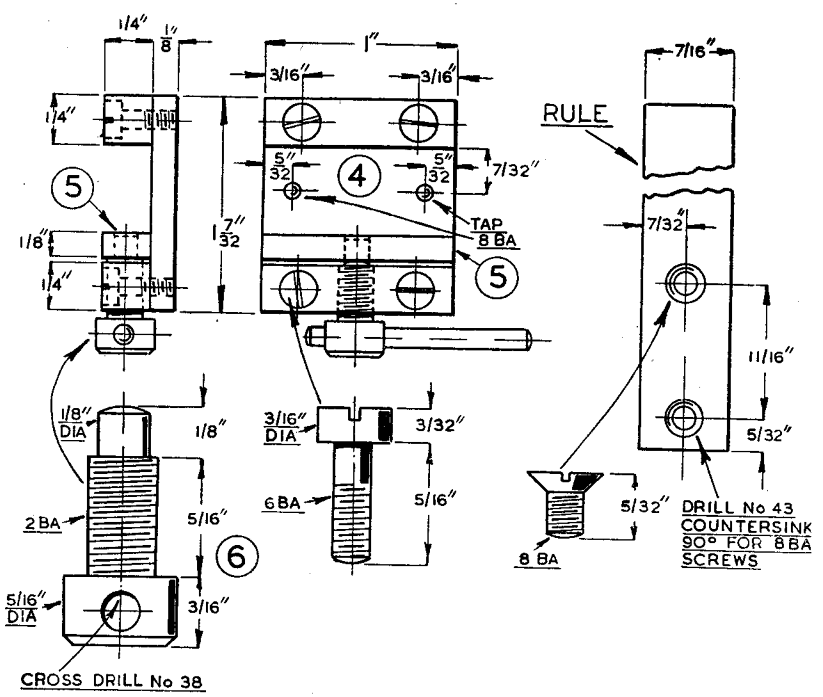


Fig. 6. The carriage for the scale

The body of the carriage, part (4), consists of a piece of mild-steel strip to which two lengths of ¼ in. square-section steel are attached to afford a means of clamping the part to the lathe rack. The actual clamp comprises a movable pad-piece (5) which is actuated by the clamping-screw (6). It will be seen that the pad is drilled to receive the turned end portion of the screw; by this means the pad is retained in place, and as it fits closely against the body it also cannot turn. The clamp-screw is provided with a tapered cross-handle which, when fully tightened, projects backwards so as to be out of the way of the index, but in a convenient position for finger operation as previously described.

It is best to postpone cutting the head of the screw to length until the position of the cross-hole has been determined by tightening the screw in place; this will also facilitate the cross-drilling operation with the part secured in the machine vice or in a cross-drilling jig. The head of the screw is cross-drilled with a No. 30 drill, and this is followed by opening out the hole with a taper pin reamer to accommodate a No. OOO taper pin.

As has been pointed out, the scales used in the two examples illustrated are made from portions of a commercial rule, and, although these are quite satisfactory in use, a better appearance will result if the scales are specially made for the purpose. The length of the rule fitted will depend on circumstances and on individual requirements, but a projection of 4½ in. beyond the carriage has been found suitable for ordinary working.

The rule is attached to the carriage by means of two 8-B.A. countersunk screws, but care must be taken to ensure that these lie flush with surface of the rule to enable the carriage to bed evenly against the rack. After the rule has been drilled and countersunk to receive the screws, it is best secured in place by making use of the carriage clamp; in this way the rule will not only be firmly held when drilling the screw-holes in the body, but it will also be fitted to lie parallel with the lathe rack when the carriage is clamped in place.

Where the rule is correctly fitted it will lie closely against the lathe rack with the carriage secured in place by means of its clamping-screw, and the index can thus be set to register exactly with the edge of the rule by employing the means of adjustment provided in the construction.

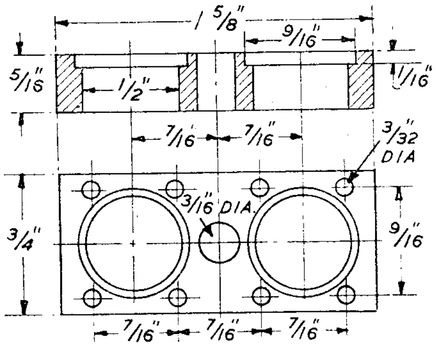
When the saddle index is not in use, it is advisable to slide the rule carriage to the right and clamp it to the rack in that position; this will ensure that the saddle, when racked towards the tailstock, cannot be inadvertently forced against the carriage.

It should be noted that the complete rule carriage can be readily removed from the rack, at any time, merely by slackening its clamping-screw for half a turn and sliding the component forwards.

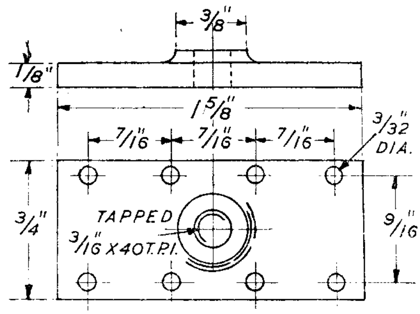
*UTILITY STEAM ENGINES

by Edgar T. Westbury

AT the time of writing the general description of the "Humming Bird" engine, which appeared in the last instalment of this series (November 3rd issue), I had intended to leave it at that, believing that the information given would be sufficient for most of the readers likely to be interested. On showing the general arrangement drawings to a number of model steam engine enthusiasts, however, I encountered a prompt and insistent demand for further information in the form of dimensioned detail drawings and some notes on machining. This points a moral—indeed, two morals, to be precise; the first is that there is a much wider interest in a very small enclosed twin steam engine than had been expected, and the second is that those critics who consider that too much space is occupied in dealing with details do not represent the majority of readers, who, I find, are rarely satisfied with the mere sketch of a design.



Spacing block



Steamchest cover

I have been asked whether the "Humming Bird" engine, installed in a boat with a suitable boiler, would produce as high a performance as its c.i. counterpart, the "Ladybird." The answer is that it is most unlikely to do so. In the first place, a small steam engine, working on the range of pressure usually obtainable from a normal form of boiler, can hardly be expected to produce anything like as much power as that produced by the high internal cylinder pressure of a c.i. engine. In the second place, even if it did attain the same power, the total power/weight ratio is inevitably lower, because the weight of the boiler and burner, over and above that of the engine itself, must necessarily be taken into account. It would be possible to increase engine performance, and decrease all-on weight, by using a flash boiler and working it at a very high steam pressure; but whether the extra complication thus entailed would be worth while is quite another matter.

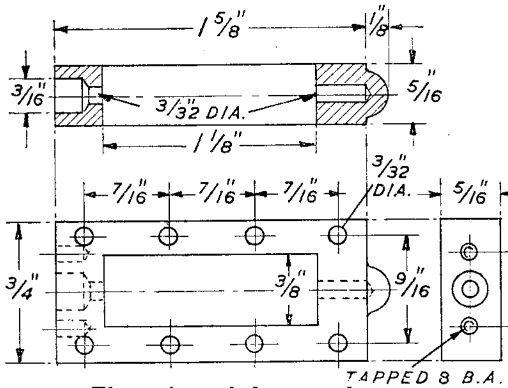
It should not, however, be assumed that the steam plant is completely outclassed for practical boat propulsion purposes, in comparison with the c.i. engines of higher power/weight ratio. Most of the small boats fitted with small c.i. engines are grossly overpowered, anyway, and though this increases their speed to some extent, it is not really efficient to pile on power in displacement types of boats, as distinct from those which are built purely and simply for racing. Let it be plainly understood that the steam engine, of any size or type, is quite capable of holding its own in prototype displacement craft which are run at reasonable and manageable speeds; and with suitable development of design, is by no means out of the running for racing craft, either. There are hundreds of simple home-built steamboats, many of them having no claim whatever to refinement of design, which have been running quietly and efficiently for years, and will continue to do so long after many of the present generation of c.i. engines have been worn out. I do not wish to make odious comparisons between steam and i.c. engines—that has been done often enough, and I regard either type as equally worthy of attention—but let us preserve a sense of proportion, and use each for the class of work to which it is best adapted. One does not set a racehorse to pull a plough, and there are many purposes in mechanical application of power where steady and consistent effort produce much more satisfactory results than tearing away at high speed.

Construction of the "Humming Bird" Engine

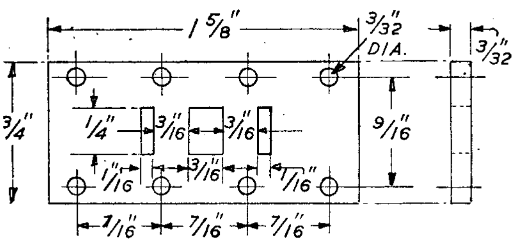
In compliance with requests, I have made detail drawings of the parts necessary for the conversion of the "Ladybird" engine to work as a steam engine. It has not been considered necessary to reproduce the drawings of those

*Continued from page 583, "M.E.," November 3, 1949.

components which are identical in both versions of the design, as these can be found in the issues of the "M.E." dated June 9th to August 4th. The parts which we are concerned with at present will supplant all those above the main cylinder block of the original engine, including the cylinder bonnets, contra-pistons and adjusting screws; the cylinder liners are



Three views of the steamchest.

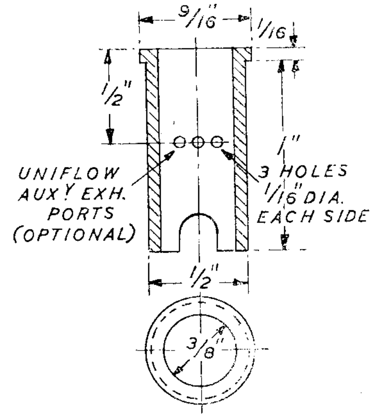


Port plate

also altered in design, and the pistons are left flat on the top instead of being machined away at the side to form the deflectors. Other parts required include the eccentric sheave and other parts of the valve operating gear.

The spacing block should first be machined, and in cases where the engine is being built entirely "from scratch," it will be advisable to machine the top and bottom surfaces of this component first, and attach it to the body casting by temporary screws, before boring the seatings for the cylinder liners, which are continued through both the components, and thereby remove any difficulty or uncertainty regarding alignment. If, however, the engine is being converted from parts already machined, it may be found best to clamp the block temporarily in position, and scribe the position of the bores from the underside. The block is then set up in the lathe so that each of the scribed circles in turn are centred as truly as possible, for drilling and boring. They may be finished a few thousandths of an inch undersize, the liners being made to suit, so that they will then be quite loose in the bores of the body, and any minor errors of location thus allowed for. Alternatively, the lower ends of the liners may be turned smaller in diameter, with the same object in view; it is, however, better practice if the bores can be lined up exactly, and the cylinder liners used to register the parts in correct location. The recesses in the top of the block can be machined by mounting the bores on a pin mandrel, in cases where the block is bored from the underside.

Some constructors may consider that some means of conserving cylinder heat by lagging would be desirable, which is quite true, though in



Cylinder liner

actual practice the extent to which a small engine of this type can be effectively heat-insulated is very limited, as every part of its surface will conduct and dissipate heat almost as effectively as the cylinder itself. It is, however, possible to dispense with the spacing block as such, by using a fabricated cylinder block, comprising the two liners brazed into parallel top and bottom flanges, which take the place of the solid block. After assembly, the space between the flanges can be filled with insulating material, and a lagging plate fastened round the outside. Note that with this form of construction, a tube should also be brazed in between the cylinders, to convey the exhaust to the outlet in the body. It will, of course, be necessary to fabricate the component of steel throughout.

Cylinder Liners

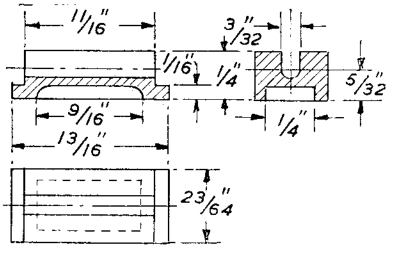
If the separate spacing block is used, the cylinder liners are made as shown, the material recommended being cast-iron, with steel as the next best substitute, and bronze a long way after it from the aspect of wear, though much superior in corrosion resistance. The machining and finishing require no comment, having been dealt with many times before; it has already been explained that the auxiliary exhaust ports are optional, and they may be added after the engine is in service, if thought desirable.

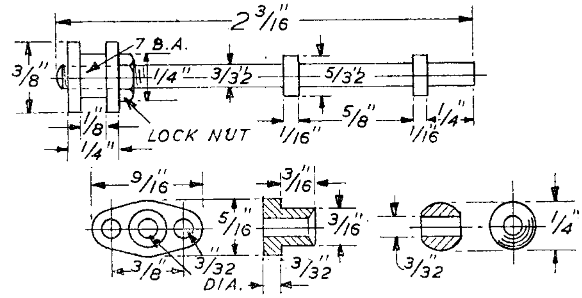
Steamchest, Cover and Port Plate

These items may be dealt with as a group, as they are all mating parts and simple in construction. The steamchest is of the well-known "picture-frame" type, and may be made either from a casting, or by cutting out the centre of a flat piece of light alloy or brass. If bright bar

is used, it should hardly be necessary to machine the faces, but they should be finished by lapping on a flat glass plate, after all other work, including drilling, is done. The same applies to the cover and port plate, the latter being, of course, finished on both sides in this way. If the holes for holding-down studs in the spacing block have already been drilled, the valve-chest components may be jigged from them, taking care to mark which end is which.

relation to length ; but it may be turned " piece-meal " with sufficient accuracy for our purpose. Hold a piece of 5/32-in. rod in the three-jaw chuck, with just sufficient length projecting to turn the rod as far as the first collar. Having done so, chamfer or round off the end slightly, then loosen the chuck and cautiously draw out a sufficient length of rod for the next instalment, taking care not to turn it round in doing so. The end may be supported by a hollow centre


Slide-valve


Valve-rod, gland and ball swivel

in the tailstock barrel, while turning the part of the rod between the collars. (You haven't got a hollow centre ? Then it's high time you made one—it will be required often enough in the future !) Deal with the outer end of the rod in the same manner, accuracy and smoothness being of special importance here, as this part works in the packing gland ; finally, cut the rod off at the required length, reverse it in the chuck, holding it over the collars to thread the end with the aid of a tailstock die-holder. The bobbin is then machined and tapped to fit the rod, and a lock-nut provided to secure it in position.

In drilling the hole in the steamchest to take the valve rod, it may be found somewhat difficult to keep the tail-end guide in true alignment and location. One way of getting over this would be to make a jig, by drilling a small block and fitting it temporarily inside the chest, clamping the cover and port plate in place to hold it in position ; but an easier way is to drill the hole from the two ends, and afterwards plug the tail-end. To ensure alignment, use a short drill running in the lathe chuck, and hold the work by hand, with the opposite centre-punch mark located on the back centre. Counterbore the front end for the gland ; it will be found that the studded gland shown is more satisfactory in this case than a screwed gland, and the latter is liable to take up more room.

Slide-valve and Rod

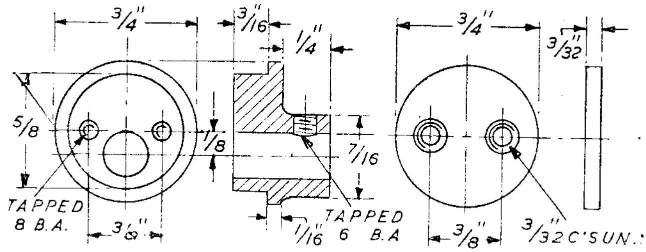
A solid block of metal (cast-iron or bronze) may be used for the valve, the recess being end-milled or chipped, according to skill or facilities, but some constructors may prefer to fabricate the valve, by brazing two layers together, the lower one having a filed-out aperture to form the recess. Whichever method is used, the important point is to ensure clean and accurate cut-off edges to the recess, though actual dimensions are not critical if the valve is made first, and the ports in the port plate afterwards made to suit. The length of the recess (in the plane of the valve-rod axis) should be exactly the same as the distance between the *inner* edges of the *outer* ports in the plate ; this produces 180 deg. exhaust timing, with neither positive nor negative exhaust lap. Steam lap is determined by the overall length of the valve face, and in certain circumstances may be subject to experimental variation, but the dimensions given will ensure good all-round results. The finished slide valve should be lapped perfectly flat and smooth.

The valve-rod may appear difficult to machine from the solid, owing to its small diameter in

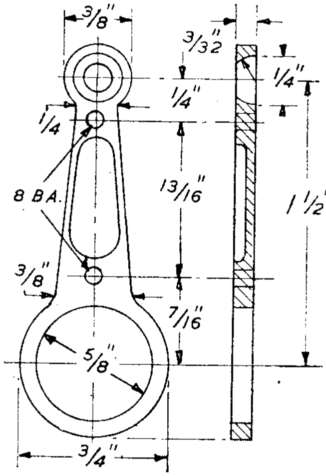
Eccentric Sheave and Rod

The methods which have been described for making eccentric sheaves on other steam engines may be applied here, the important point being to ensure parallelism of the bore and eccentric axes. Before finishing the eccentric surface, the flat plate which forms the eccentric cheek may be attached, and skimmed over the outer edge to ensure that it matches the rim of the sheave. If the crankshaft is to be extended to provide a rear end drive, a hole must be drilled through the cheek in line with the bore of the sheave ; the latter may be used as a jig for this operation.

As the top end of the eccentric rod must have a part-spherical bearing for the ball joint, it is best made in two layers, each having a hemispherical recess to receive the ball. There are other methods of construction which might be adopted for this part, but it is believed that this is the simplest which gives satisfactory results. It is recommended that the two layers should be cut from 3/32 in. duralumin sheet (not pure aluminium or other soft alloy) and clamped together by the two screws for boring the eye forming the eccentric strap, which may be done



Eccentric sheave and check

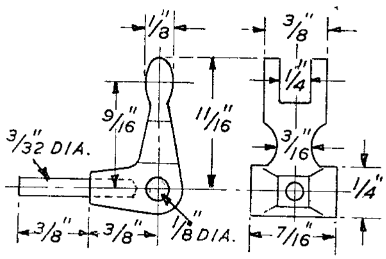


Eccentric strap and rod

by holding the assembly in the three-jaw chuck. Make this bore a close running fit for the eccentric sheave, on the tight side rather than otherwise, as it can be eased off in fitting. The hole in the centre of the top end eye can then be drilled, and the layers are then taken apart for counterboring the spherical recesses from the inside surfaces. A simple D-bit may be used for this operation, and is made by rounding off the end of a piece of ¼-in. silver-steel rod—use a ⅛ in. radius gauge and examine with a lens to ensure accuracy—then filing away exactly half the diameter, and hardening in oil. Use the ball itself as a gauge in assessing the depth of the recess, which should be equal in each layer, and just allow the two layers to make contact when clamped together, without gripping the ball. It has already been explained that a steel bearing ball can be softened for drilling through the centre (in the lathe chuck) and afterwards re-hardened.

Valve Rocker and Bracket

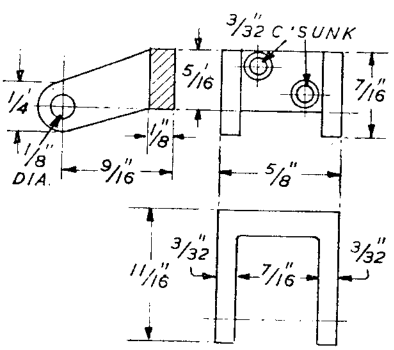
These parts may be either fabricated, or made from the solid by filing or milling. The former



Valve rocker

method is applicable only to metals which can readily be joined by brazing or other available processes, and in my opinion, do not save much time in making these small components. It is not a long job to file either of them from the solid, and in the case of the bracket, duralumin is quite suitable. It will be seen that the lower leg of the rocker has the pin on which the ball works inserted by pressing in, which is simpler than machining from solid and quite satisfactory if it is made a good press-fit. Use a No. 43 drill to produce the hole, and a piece of 3/32-in. silver-steel rod, slightly tapered at the end, for the pin. A screwed-in pin (7 B.A.) may be used if preferred, but will be of less strength than if pressed in. Silver-steel may be used also for the rocker pivot pin, which, as shown, is simply a plain length of ⅛-in. rod, made a press-fit in the rocker, by drilling the latter with a No. 31 drill, and the ends of the pin are slightly burred over to prevent working out. A headed pin may be fitted if preferred.

For setting the slide-valve, the same methods as described for the more usual forms of slide-valve engines may be adopted. First set the position of the collar on the valve stem, so that the amount of port opening is equal at either end, with the eccentric at the top and bottom of its stroke. Then turn the engine to top dead centre of one cylinder (the flywheel should be marked to indicate this) and set the eccentric on the shaft



Rocker bracket

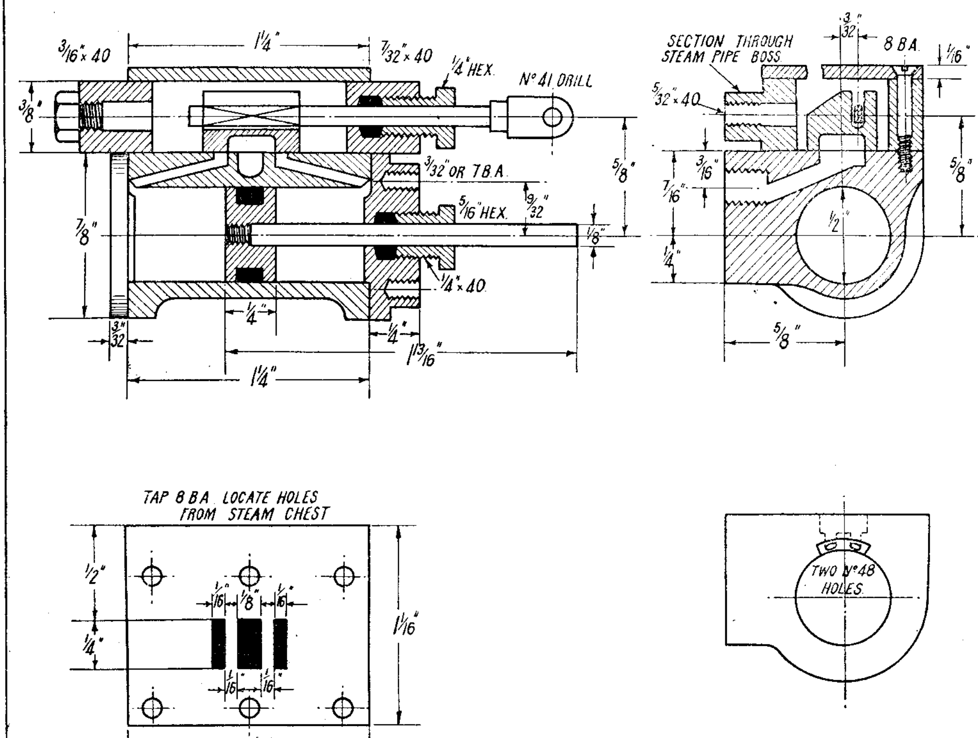
so that the port to this cylinder is just beginning to open, as the shaft turns in the appropriate direction. Slight adjustment of the eccentric position may be found beneficial in certain circumstances, and should be tried experimentally before finally fixing the eccentric by " dimpling " the shaft to take the point of the grub-screw.

(*To be continued*)

Cylinders for the Wee "Dot" like "Doris"

by "L.B.S.C."

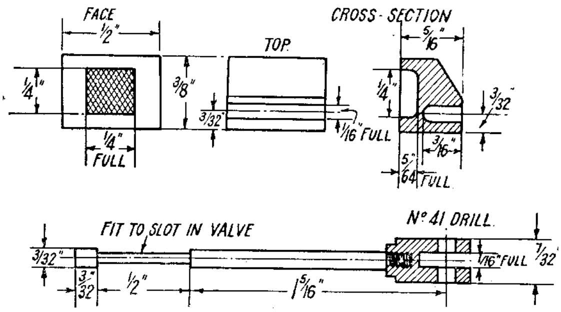
IF anybody cares to tackle a pair of proper piston-valve cylinders for "Doris's" baby sister, all they have to do, is to halve the dimensions of the $3\frac{1}{2}$-in. gauge pair, and go right ahead. If they prefer slide valves, they will find all they need in the way of dimensions, in the accompanying illustrations. I used a similar pair on a gauge "1" engine of the 2-6-0 type, which I built for an old fellow-conspirator of the railway, now alas! on the other side of the Great Divide. They were bored out to a shade over $\frac{9}{16}$ in., as big as the castings would allow; and the engine ran away with a twelve-year-old boy, on the steam generated by six $\frac{1}{4}$-in. "poison-gas" wicks. The boiler was smaller than that I am specifying for "Dot." Although I have shown the bores as $\frac{1}{2}$ in. in the drawings, it is quite all right to bore them a little larger if you so desire. As long as the chimney liner and blast nozzle are O.K., so as to get enough air through the firebox, to ensure complete combustion—"take all the poison out of the gas," as my lamented friend used to say—there won't be any steaming trouble. Better results still, could be obtained by fitting one of my small oil burners, blueprints of which are now available from our offices. Cylinders of $\frac{5}{8}$ in. bore could be used, if the boiler is fired by an oil burner in good fettle.



Cylinders for "Dot"

The general instructions for machining and fitting the cylinders on the $3\frac{1}{2}$-in. gauge engine, can be applied to the smaller one, making variations where necessary. These small castings, however, need not necessarily be set up on an angle-plate for boring; if your four-jaw chuck will hold them, use that. The *modus operandi* is practically the same. If the core-hole in the casting is in the right place, just set it to run truly; then face the end flange, bore and ream, and finish the other end on a stub mandrel. If the core-hole is out of truth, mark a circle on the end, and set it to a scribing-block needle, with the scribing block standing on the lathe bed or saddle. If beginners haven't a scribing block, and finances are well below par, make one up; it is easy enough. You would have laughed to see young Curly's first attempt at a scribing

block. The base was a small " press-in " type tin lid ; the spindle was a bit of stiff wire bent at right angles at the bottom, and soldered to the lid, the flange of which rested on the lathe bed or whatever was being used. Mother's flat iron made a swell " surface plate " ! The needle was one of mother's hat-pins. I found out how to make the block that carries the needle, from gazing at a proper scribing block in a tool-shop window ; but mine was very much modified, as I used an old bolt with a wing nut. A hole close to the bolt head, through which the wire spindle passed, and was clamped by the wing nut, provided height adjustment, while the hat-pin was clamped between two washers, placed between the wing nut and the spindle. " Where there's a will, there's a way," and " necessity is the mother of invention," were two sayings which might have been specially inspired by young Curly's antics. In later years, I made a good scribing block with a locomotive wheel for a base ; and also made vee-blocks by riveting two pieces of sheet metal together and filing to shape, like



Slide-valve and spindle

you would do to cut out frames, and then fixing them (after filing a vee in one edge) at ½ in. apart, with three little spacers. Incidentally, I wrote to a certain party and mentioned these wheezes. He promptly wrote an article in which he claimed the ideas as his own ; such is life ! Many of the improvements in small locomotive construction, as described in these notes, have been —and are still being—exploited commercially ; not that it worries me in the least, but as our 'Oxton friend, Bert Smiff would remark, " Us blokes ain't above a bit o' scroungin', but we're 'onest enuff to say where we got the goods ! " Nuff sed.

Sometimes these small cylinders are cast solid. In that case, all you do is to mark out one end and centre-pop the middle of the location of bore ; chuck in the four-jaw, run the tailstock up to the casting, and adjust jaws until the pop-mark is true with the tailstock centre. Alternatively, you can hold the casting against the tailstock centre, with the point in the pop-mark, and close the chuck jaws down on to it. Put a ⅛-in. pilot hole through first, then drill $\frac{7}{16}$ in., take a cut through with a boring tool, in case the drill has run out of truth, and finally ream.

The casting can be held crosswise in the chuck, for facing off the port face and bolting face ; but put a piece of 16-gauge or thicker metal, such as soft brass or aluminium, between the machined ends and the chuck jaws. Set with a try-square, same as if you had the job on an angle-plate. The ports may be end-milled by one of the several methods I have previously described, or be hand-cut with a small chisel ; if end-milled, it doesn't matter a bean if the ends are left semicircular. The passageways should be drilled by hand, the casting being held in the bench vice, on the slant, so that if the brace is held level, it will direct the drill into the side of the port, and avoid breaking through the port face.

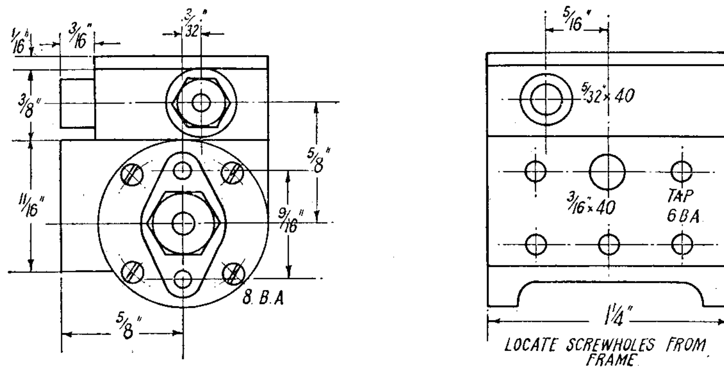
Covers, Pistons and Glands

The cylinder covers and pistons are machined and fitted, same as described for the 3½-in. gauge job. After mounting the rough-turned pistons on their rods, hold the rods in a split-bush in the three-jaw, if you haven't a collet chuck, for finish-turning the pistons to size. Somebody I know, hadn't a three-jaw, so he turned the lot between centres. If the lathe is a very small one, and the veracity of the chuck is nothing to write home about, it might be advisable to follow suit. My first tiny lathe didn't have any three-jaw, only a few brass chucks of the kind that unofficial history tells us, were used on the lathe in the engine-room of Noah's Ark ; but I seemed to get on all right by aid of a few spots of improvisation. I didn't even have a slide-rest ; but, as followers of these notes who have read my childhood reminiscences will recollect, the abnormal physical strength which I possessed when a child, enabled me to hold a hand-tool perfectly rigid for the few simple jobs that I carried through. Incidentally, I'm not exactly a weakling now ; a few days ago, when a friend from Ashford saw me pick up a heavy tray of castings by the edge, with one hand, he said in surprise, " Curly, you haven't half got a strong wrist ! " I might add, it takes the two of them to carry the 2-6-6-4 Mallet " Annabel " down a flight of stairs, and up a sloping garden path to our little railway.

Beginners note the following : make a dummy plug for the stuffing-box in the back cylinder cover. Just chuck a bit of ¼-in. brass rod in three-jaw, face the end, screw for about ¼ in. length with ¼ in. by 40 die in tailstock holder, and part off a slice about ⅛ in. thick. The centre of this will be automatically marked by the facing tool. Scribe a line right down the middle of the oval boss, cutting through the centre of the plug, which should be temporarily screwed into the stuffing-box. At 9/32 in. above and below centre, make two centre-dots ; drill No. 48 and tap 3/32 in. or 7 B.A., using drilling-machine or lathe — *not* by hand. These holes are for the guide bars, and if they are not dead square with the cylinder cover, the bars won't line up with the piston rod.

Drill the four No. 43 screw-holes in the cylinder cover, and put the cover on the end of the cylinder. Lay the cylinder, bolting face down, on the lathe bed ; set your scribing-block needle to the centre of the dummy plug, and adjust

the cover until the centres of the guide-bar holes are at the same height. Put a cramp over the cylinder and cover, to prevent the latter shifting, then run the 43 drill through the holes, making countersinks on the cylinder flange ; follow with No. 51 and tap 8 B.A. The piston-rod glands



Back view and bolting face of R.H. cylinder

are turned from $\frac{5}{16}$-in. hexagon rod, bronze or gunmetal for preference.

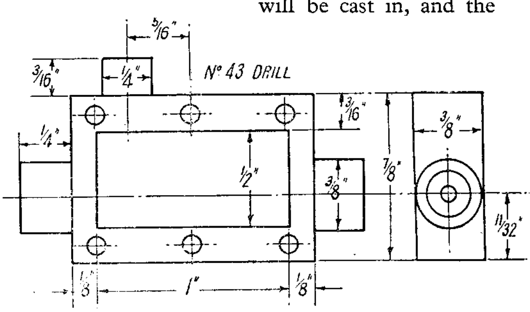
Steamchests

Castings for the steamchest will have the bosses cast on. Chuck one boss in the three-jaw, and set the other one to run truly ; centre it with a centre-drill in the tailstock chuck. Run up the back centre to support it whilst you turn the outside, and face the end of the steamchest ; then drill it through with No. 41 drill, and open out and tap 7/32 in. by 40 for the gland. Reverse in chuck, repeat operations for the other boss, but drill it right through with 5/32 in. or No. 22 drill, and tap $\frac{3}{16}$ in. by 40 for a plug, which is made from a bit of $\frac{1}{4}$-in. hexagon brass rod. Use bronze or gunmetal rod, if possible, for the gland. The steam pipe boss at the side, need not be turned ; just smooth off the end with a file, centre, drill No. 30, and tap 5/32 in. by 40. Both sides or contact faces of the steamchest can be machined off with the casting held in a four-jaw chuck.

Drill the screw-holes ; then cut out a piece of $\frac{1}{16}$-in. sheet brass for the cover-plate, $1\frac{1}{4}$ in. long and $\frac{7}{8}$ in. wide. Drill this by clamping the steamchest to it, and using the screw-holes in same as guide. Then clamp the steamchest to the port face, and make countersinks on same by running the No. 43 drill through the screw-holes. Remove steamchest, drill countersinks No. 51 and tap 8 B.A. Use 8-B.A. countersunk steel screws to hold the lot together, countersinking the holes in the steamchest cover-plate to match.

Valves and Spindles

The slide valves may be castings, or cut from a bit of bronze or gunmetal bar, either $\frac{3}{8}$ in. by $\frac{5}{16}$ in. section, or $\frac{3}{8}$ in. square. Hold it in four-jaw and part off the two lengths to size. The slots for valve spindles can be best cut, if a regular milling-machine isn't available, by clamping the valve in a machine-vice—or improvisation thereof, as described in the Beginners' Corner a little while ago—and running under a $\frac{1}{16}$ in. wide saw-type milling cutter on a spindle between centres. It may also be cut on a shaper or planer, by aid of a $\frac{1}{16}$-in. parting tool in the clapper box. Alternatively, a No. 51 hole could be drilled longitudinally through the valve, at the location of the bottom of the slot ; a saw-cut made from the top of the valve, down to the hole, by aid of two saw-blades put together in the frame, and the sides then smoothed with a key-cutter's warding file. Also a 16-gauge slotting blade in that most handy gadget, the Eclipse "4S" tool, would do the job in two wags of a dog's tail. If castings are used, the exhaust cavity will be cast in, and the



Steamchest

valve will be externally to the shape shown. If cut from solid, file off the corner of the valve (no need for "mike" measurements on that job, even by our old friend Inspector Meticulous himself !), and form the cavity by making a countersink on the sliding face with a $\frac{1}{4}$-in. drill, and chipping it square by aid of a little chisel made from a bit of $\frac{1}{8}$-in. round or square silver-steel. If the length of the cutting edge equals the length of the cavity, you don't get any mouse-nibbled edges. Same applies to hand-cut ports.

The valve spindles are made from $1\frac{3}{4}$-in. lengths of 3/32-in. rustless steel or bronze rod. One end has a few threads, 3/32 in. or 7 B.A. cut on it ; the other end is filed flat to fit in the slot in the back of the valve, starting at 3/32 in. from the end. I usually chuck the spindle in the three-jaw for screwing, then reverse it, and turn a couple of scratches with the point of a knife-tool, at the start and finish of the flattened portion. One of these (the one farthest from the end, naturally !) is placed level with the chuck jaws ; and with one of the jaws set to twelve o'clock, and the file held horizontally, a flat is formed. The same jaw is then turned around to six o'clock, and the other flat filed. The length of the flat is checked by applying the valve itself to the job.

The flats should fit the slots easily, but should not have any appreciable end movement, otherwise the valve setting will be faulty. The fork on the end of the spindle is made the same as described for umpteen other engines, so needs no detailing. Use oiled paper, or 1/64-in. Hallite or similar jointing, between cylinder casting, covers, and steamchest joints; pack piston and glands with graphited yarn, and Bob's your uncle as far as the cylinders are concerned. Next stage, guide bars, crossheads, connecting-rods and valve-gear.

Beginners' Corner (contd.). Pump for "Tich"

We left off after finishing the pump barrel and valve-box, so now we need the top and bottom caps for the valve-box. The valves themselves are 5/32-in. balls, either rustless steel or phosphor-bronze. If you are using the former, drop one into the D-bitted end of the valve-box; rest the other end on a block of lead, or something else that won't damage the faced end. Put a short bit of $\frac{3}{16}$-in. round brass rod on top of the ball, and give it just one sharp crack with a hammer. This takes the sharp arris off the edge of the reamed hole, and the ball thus forms its own watertight seating. If you are using bronze balls, form the seating as above, with a 5/32-in. cycle bearing ball; *not* the bronze ball. The latter isn't nearly so hard as the steel ball, and the seating will cut a weeny groove in it, if you try to seat it direct. The bronze ball will seat watertight on a seating formed by a cycle ball of similar size.

Now take the distance from the top of the ball, to the top of the valve-box, with a depth gauge. Young Curly's depth gauge was one of mother's hat-pins stuck through a tram ticket. You can make one by drilling a No. 41 hole through an inch or so of $\frac{3}{16}$-in. square brass rod, putting a 3/32-in. or 7-B.A. set-screw in the side, and using a piece of 3/32-in. silver-steel, about 3 in. long, for the sliding part. Put the rod across the top of the valve-box; push the pin down until it touches the ball, and tighten the screw. You'll need this in a few minutes, all being well.

The top cover of the valve-box is in the form of a T, the stem screwing into the valve-box, and the two ends of the head carrying union screws for connecting to the boiler clack and the by-pass valve respectively. It can be made from a casting, or built up. If cast, it will look like a cross, as it will have a chucking piece on top. First, chuck in three-jaw by one side of the head, and set the other end to run truly, gently tapping with a lead hammer, or something else that won't damage the casting, until it doesn't wobble when the lathe is running. Then tighten the chuck. Face off the end carefully; for nearly all facing jobs on small fittings, I use a square-ended tool, with the point nearest the chuck, ground off to an angle of about 30 deg. An ordinary knife-tool sometimes catches up and knocks the job clean out of the chuck, damaging the soft casting beyond recall. The tool above mentioned, never plays that trick, and is also useful for chamfering the corners of union nuts and similar fittings.

Centre the end, same as you centred the wheels, letting the centre-drill penetrate until it has sunk in far enough to leave a countersink which measures a full $\frac{3}{16}$ in. across. Then turn the outside for $\frac{1}{4}$ in. length, to $\frac{1}{4}$ in. diameter, using a knife-tool as when turning wheel seats, and screw it $\frac{1}{4}$ in. by 40, with the die in tailstock holder. You obviously can't reverse the job in the chuck, to turn and screw the other end, as the chuck jaws would have to be tightened enough to ruin the threaded part; so use a tapped bush. Chuck a short bit of $\frac{1}{2}$-in. round rod in three-jaw; any odd scrap, brass or steel, about $\frac{1}{2}$ in. long, will do fine. Face the end, centre, drill right through with 7/32-in. drill, slightly countersink the end with $\frac{1}{4}$-in. drill, tap $\frac{1}{4}$ in. by 40, using the tailstock chuck to guide the tap, as previously described, and skim off any burr left from drilling and tapping. Don't remove from chuck, but screw the threaded end of the tee into it. The outer end will run quite truly. Give that end a dose of the same medicine as the first end; and then drill right through it with a No. 40 drill, as shown in the section of the complete pump. Make a centre-pop opposite No. 1 jaw, on the bush, before taking it out of the chuck.

Now chuck the casting by the spigot on top, provided for the purpose. Set the stem to run truly, as above. Face off the end; centre, and drill it with a No. 40 drill until you break into the cross-hole at the top. The next bit is where you need the already-set depth gauge; turn the stem to $\frac{1}{4}$ in. diameter, to the same length as indicated by the projecting part of the depth gauge pin. Screw it $\frac{1}{4}$ in. by 40, and then face just 1/32 in. off the end, to allow the ball that much lift. Finally, file two nicks across the end, with a thin flat file, so that when the ball rises off its seating on the forcing stroke of the pump, and seats against the hole, the water can get out through the nicks. An old friend forgot these nicks on one of his engines, and spent about a fortnight looking for the tight spot, error in valve-gear, etc., which he imagined was causing the wheels to lock as soon as the engine tried to make a start! Cut off the chucking piece, and file away the stub, making the fitting as neat as possible; then drop the ball in the valve-box, and screw the fitting home, with a touch of plumbers' jointing ("Boss White," or any similar preparation, sold at all ironmongery stores) on the threads; but be careful not to get any inside the valve-box. The union screws should point fore-and-aft, as our nautical friends would remark; see sectional drawing.

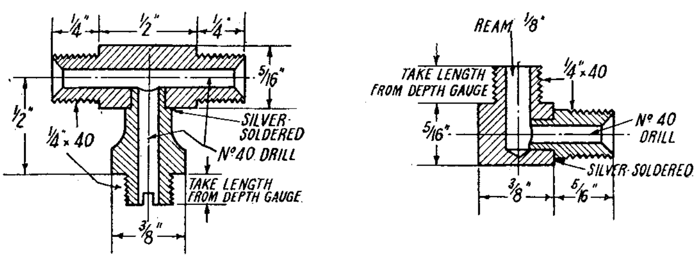
The bottom fitting is somewhat similarly machined, but it has only one union screw, and the ball seats on the stem. The fitting will have two chucking pieces, so chuck in three-jaw by one of them; set the other end to run truly, then face, centre, turn and screw it, exactly as described for the union ends of the tee above. Then drill halfway through it with No. 40 drill. Next, chuck by the other chucking piece, and set the end to run truly. Face off, centre, and drill down with No. 32 drill until you break into the hole already drilled; see section of complete pump. Put a $\frac{1}{8}$-in. parallel reamer into this hole, as far as it will go; then carefully face off the end.

Turn the pump upside down, and drop a 5/32-in. ball into the lower part of the valve-box. Take the distance from the top of the ball, to

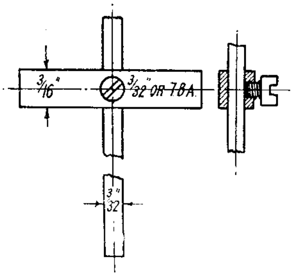
the end of the valve-box as before, and tighten the set-screw of the depth gauge. Now turn the stem of the fitting in the chuck, to $\frac{1}{4}$ in. diameter, for a distance approximately 1/64 in. less than the length indicated by the gauge pin, and screw it $\frac{1}{4}$ in. by 40. As the ball sinks into the seating a little, this will give the ball a shade over 1/32 in. total lift. Saw off both chucking pieces, and smooth the stubs away with a file; put the ball (if steel) on the end of the stem, apply the brass illustration. Squeeze it in, and silver-solder the joint, afterwards cross-nicking it, same as the casting.

Silver-soldering Fittings

This is one of the easiest jobs going. I use "Easyflo" silver-solder in wire form (supplied commercially by Johnson-Matthey's) and the special flux that goes with it; but best grade silver-solder cut in thin strips, with jewellers



Built-up pump fittings



Simple depth gauge

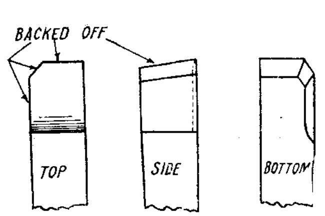
rod to it, and give it a crack with a hammer as above. The fitting can be held in the bench vice for this job. Then drop the ball in the hole in the valve-box, and screw in the fitting, with the union screw pointing towards the pump barrel, as shown in the section of the complete pump.

Built-up Fittings

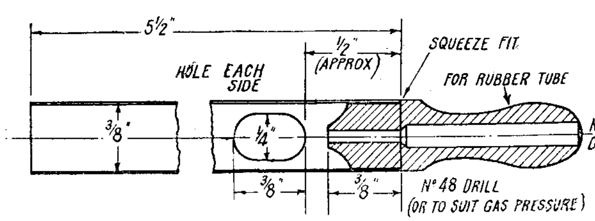
Instead of using castings, the top and bottom fittings may be built-up. For the top one, chuck a piece of $\frac{5}{16}$-in. round brass rod in the three-jaw. Face the end, centre deeply, and turn and screw it exactly as described for the casting; part off at 1 in. from the end. Reverse in chuck, and serve the other end the same, drilling a No. 40 hole clean through. Drill a 5/32-in. hole in the side, halfway along, breaking into the middle hole.

Chuck a piece of $\frac{3}{8}$-in. brass rod in three-jaw; face, centre, and drill down $\frac{3}{8}$ in. depth with No. 40 drill. Face off the end until any countersinking has been removed; then turn the end to $\frac{1}{4}$ in. diameter, to 1/32 in. less than distance from top of ball to top of box, as indicated by the depth gauge. Screw $\frac{1}{4}$ in. by 40, and part off at $\frac{5}{8}$ in. from the end. Put the tapped bush in the chuck, with the centre-pop opposite No. 1 jaw, and screw the fitting into it. Turn $\frac{1}{16}$ in. of the end, to a tight fit in the side hole in the other piece; then turn the rest to the shape shown in the

borax (powdered and mixed to a paste with water) does very well. You can use a little blowlamp, or a small gas blowpipe can be made in a few minutes from a bit of $\frac{3}{8}$-in. brass or copper tube, which is self-blowing. See illustration, which explains itself. A small tin lid with a few bits of small coke or asbestos cubes in it, makes a small forge; it need not be bigger than a soap dish. Simply anoint the joint with the wet flux, blow to medium red, and touch the joint with the silver-solder wire or strip. It immediately melts and runs in. Don't use too much—it not only spoils the appearance, but is expensive. Quench out when it has cooled to black, in a drop of acid pickle in a jam jar. The acid pickle is composed of 1 part commercial sulphuric acid to about 16 of water, or 1 part old accumulator acid to 4 of water. Let the fitting stay in for about ten minutes, then fish it out, wash under the kitchen tap, wipe dry and clean up. For cleaning up, I use a circular wire brush on a spindle stuck in a taper hole in the end of my electric grinder; but it does as well if held in the lathe chuck. Run the lathe as fast as possible without causing an earthquake.



Facing and chamfering tool

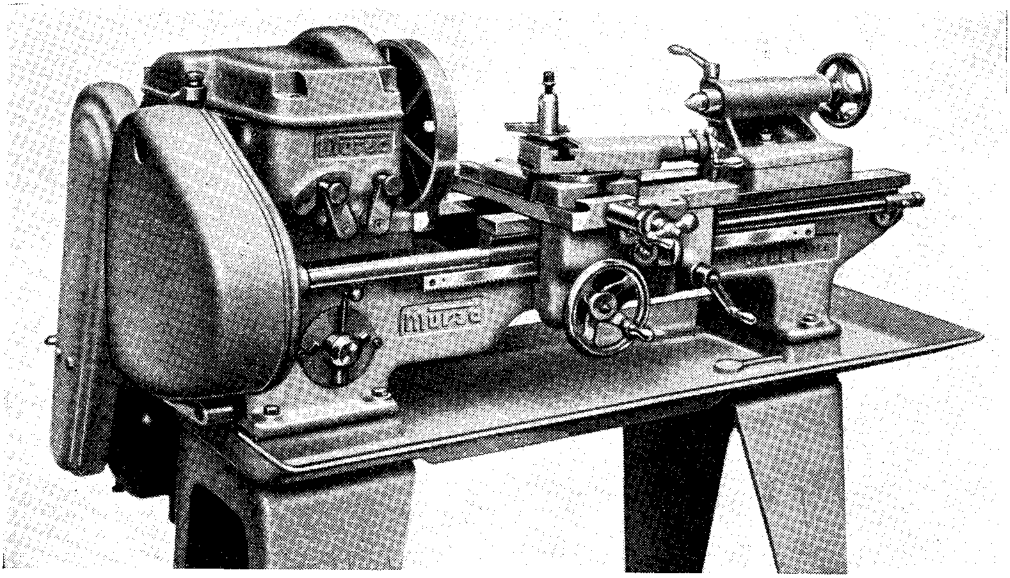


Simple self-blowing gas blowpipe

The bottom fitting is easier still to build up. Simply chuck a bit of $\frac{3}{8}$-in. brass rod in three-jaw, and proceed to machine up the end exactly

(*Continued on next page*)

The Murad "Cadet" 4-in. Lathe



Messrs. Murad Developments Ltd., of Stocklade, Aylesbury, Bucks, have recently introduced a new 4-in. lathe which embodies several interesting features. It has a centre height of 4 in., with a gap bed, admitting a maximum diameter of 11 in. in the gap, and maximum length of 18 in. between centres. The headstock has an all-geared drive, giving six speeds from 43 to 818 r.p.m. and the mandrel, which has a through bore of 13/16 in. with No. 3 Morse taper socket, runs in large-diameter, long white metal bearings. The standard set of change-wheels provides for cutting threads from $2\frac{1}{2}$ to 96 t.p.i., and saddle feeds from 0.400 to 0.0037.

A cast-iron stand is supplied, and also a cast tray, with machined seatings for the feet of the lathe, serving to increase its rigidity and further resist distortion. The electrical equipment consists of a $\frac{1}{2}$ h.p. motor bolted to the back of the stand and driving the enclosed gear countershaft by vee-belt, also a built-in motor reversing switch below the headstock. Standard equipment includes driver plate, two centres, set of change gears, and necessary spanners; extras include 8-in. faceplate, fixed and travelling steadies, independent and self-centring chucks, chasing dial, 4-way turret toolpost, and collet attachment. A long bed machine, taking 24 in. between centres, is also available to order.

"L.B.S.C."

(*Continued from previous page*)

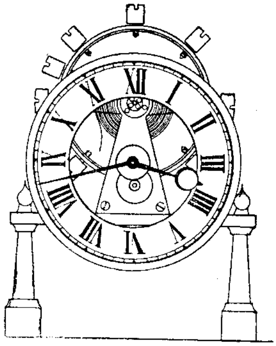
as described for the casting, when forming the ball seat. Part off at $\frac{5}{16}$ in. from the shoulder, and drill a 5/32-in. hole in the side. Chuck a piece of $\frac{1}{4}$-in. round rod in the three-jaw; face the end, centre deeply, and drill down to a full $\frac{1}{2}$ in. depth with No. 40 drill. Screw the outside $\frac{1}{4}$ in. by 40, for $\frac{1}{4}$ in. length, and part off at $\frac{3}{8}$ in. from the end. Rechuck in the tapped bush; turn about 3/32 in. of the end to a tight squeeze fit in the side hole of the other part. Squeeze it in, silver-solder it, pickle, wash and clean up. Seat a ball on the faced end, and assemble as previously explained.

May I beg your forgiveness for a small error in the notes in August 25th issue, in which I said, erect the pump stay level with bottom of frame. It should be placed $\frac{1}{16}$ in. above the bottom, so as to line up the pump barrel with the centre of driving axle in running position. Most builders put it thus, as the position of the screw-holes gave the necessary clue; but if anybody has put it level with the bottom of the frame, it doesn't matter a bean. As the distance between the eccentric-strap centre, and the eye in the rod is 2 in., the $\frac{1}{16}$ in. offset won't affect the working of the pump in the slightest. I just mixed up the pump for "Tich" with one I schemed out for another engine!

*An Electric Clock

with a Semi-free Balance

by Stanley J. Wise, F.B.H.I.



TURN the contact roller from good quality gunmetal, or dark brass, to dimensions in Fig. 10. Leave centre hole slightly smaller and ream to a perfect fit on $\frac{3}{16}$ in. diameter balance staff. Finish all faces to medium grain, except the edge, which should be "dead" polished. Drill and tap the two 10-B.A. clamping screw holes in the boss, and also a $\frac{3}{16}$ in. hole for the contact pin, which is, of course, insulated.

The contact pin can now be constructed by suitably turning and drilling a standard 10-B.A. cheese-headed screw to measurements as given; make the actual pin a very tight fit in centre hole, whose depth should be at least three times the diameter of pin. Turn the insulated bush and washer from bakelite or similar.

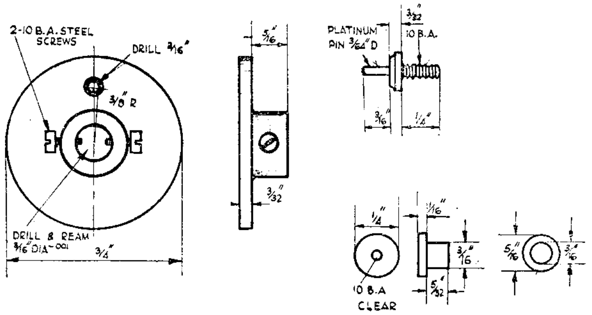


Fig. 10. *Details of contact roller, pins and insulation bushes*

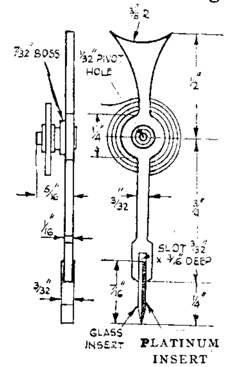


Fig. 11. *Details of contact switch*

It is practically essential to use platinum for the pin, but tungsten would do; the working of this latter metal, however, is difficult, owing to its hardness, but it can be ground quite easily. Burnish both the pin and its mounting collet. Finally clamp the assembly tightly into its position on disc, with one 10-B.A. hex. nut.

Contact Switch

Shape to measurements from mild-steel as specified in Fig. 11. Drill a 5/32 in. centre hole to accommodate the bearing collet. Straight grain both faces, dead flat, to No. O emery buff-stick and burnish the edges.

The cutting of slot must be very carefully done preferably by milling in lathe; if, however, filing is the only method available, start with a fine slot, working up to finished size gradually using superfine files with keen edges only. Shape a piece of platinum or tungsten to a little above the measurements shown and sweat into its position with one face abutting the inside right-hand horn of slot. Carefully file out the remaining space between left-hand horn and platinum slip. Finally shape the outside edges to conform (within small limits) to that shown.

"Dress" down a scrap of fairly thin glass with an oilstone until it just slides nicely into the space formed between platinum slip and the remaining horn. Form the sides and length to a little over finished measurements and gently press into position, securing it with a spot of shellac, warming the end of lever in the meantime. With a fine carborundum slip, "dress" both the platinum and glass on the working faces to a fairly steep taper as shown, leaving the merest resemblance of an edge at the point; if anything, the glass can be slightly "proud." Reduce the sides to measurements (using an oilstone) and finally polish both working faces—first with an oilstone, then with buffstick and rouge. Although this job requires a rather high order of workmanship, it is quite easy if care is taken in handling while working on the slips.

Drill and turn the centre bush, leaving the pivot hole slightly small. Make sure that the spigot fits tightly into its centre hole. The opposite end must now be carefully turned down to fit fairly tight into a standard hair-spring collet. Any hairspring taken from a 30-hour 2½-in. cheap type movement would be suitable provided it is non-magnetic.

*Continued from page 606, "M.E.," November 10, 1949.

Press the finished bush into its hole in lever and gently burr over the outer edge of spigot to secure. Make sure when doing this that hairspring mounting is at back, when platinum slip faces right.

Contact Components

Proceed to make the following items as enumerated on the drawing, Fig. 12 :—

(1) Contact lever mounting plate, from hard brass ; finish sides to medium grain, burnish edges.

(2) Contact lever retaining cock. Bend up from 1/64-in. clock spring, after well softening.

(3) Turn from silver-steel and highly polish working surfaces.

(4) Contact lever pivot bush ; turn from hard fibre or bakelite.

(5) Contact pivot back washer, turn as above.

(6) Hairspring stud insulating bush. Turn from bakelite to measurement shown.

Rear Bearing Pedestal

Mark out and shape up the supporting plate, base, and strengthening web from $\frac{1}{8}$-in. sheet brass, drilling accurately a $\frac{1}{16}$ in. hole through the bearing centre. The items thus roughly formed can now be attached together, forming a complete pedestal, in the following manner.

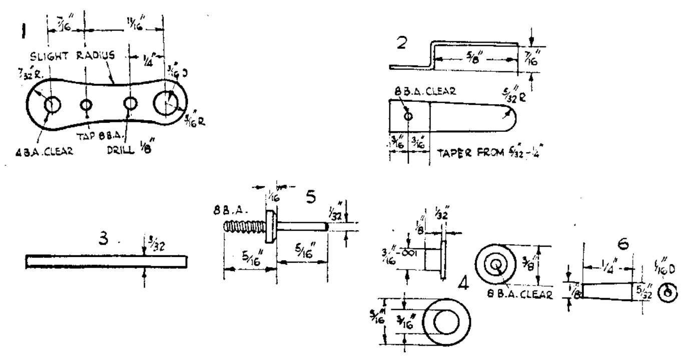


Fig. 12. *Details of contact components*

(*a*) Drill three equally spaced 3/64-in. holes through the centre line of main plate, one positioned exactly $\frac{7}{8}$ in. from the bottom edge (which is the centre of strengthening web) and two displaced from centre by $\frac{7}{16}$ in. Drill two similar holes through baseplate $\frac{1}{16}$ in. from back edge, but pitched $\frac{3}{4}$ in. from each other.

(*b*) Clamp the base very carefully into position abutting bottom edge of main plate (which is best done by clamping to an angle-plate) and mark off the position, holes will assume in the exact centre of the $\frac{1}{8}$ in. abutting edge of plate. While in this position, drill one pin hole, using baseplate as a jig.

(*c*) Remove from angle-plate and partly secure base by driving in tightly a slightly oversize taper pin, being careful to remove all burrs before so doing.

(*d*) Carefully line up the base in its exact position and drill the remaining pin hole, finally securing with a 3/64-in. pin as above.

(*e*) Treat the junction, i.e. plate and base, with a suitable flux and sweat thoroughly into the joint with soft solder and allow to cool.

(*f*) Clean up the job, removing all surplus solder, especially from the right-angled space accommodating the lower end of strengthening web. Check this carefully by a square.

(*g*) Clamp the strengthening web into position, marking out and drilling as above. Pin up tightly.

(*h*) When almost cool immerse the job into a weak caustic solution and stir well. This will remove all traces of flux and thereby prevent corrosion later on.

(*i*) With the job clamped on a faceplate in lathe, accurately attain the bearing centre (by slight displacement of the job, here and there) until the $\frac{1}{16}$-in. centre hole, already drilled, runs dead true. A $\frac{1}{16}$-in. drill can be inserted into the hole to facilitate this.

(*j*) Bore out the bearing centre hole to measurement shown and lightly skim the face to ensure a dead square abutment of the housing flange ; also mark off the position of anchorage screws.

The job can now be cleaned up and finished ; a light sand-blast matt surface looks very nice on the flanks between the webs. Alternatively, clean as far as possible, working into corners with a keen scraper, finally finishing with medium grade emery and steel scratch-brush. These surfaces can subsequently be enamelled dark green, a very pleasing effect with this will thus be given. Slightly round and burnish all edges, except those of base and underface which should be straight grained, No. O buff-stick. The appearance of the latter surface can be further enhanced by "snailing" or "feathering," but more will be said about this later. Drill and tap the three 12-B.A. holes for housing flange attachment, which is best carried out by direct drilling, using the flange itself for a jig. Fig. 13 shows the finished pedestal.

Front Bearing Pedestal

Mark out and shape the backplate as shown in Fig. 14, which to a great extent, is almost identical to that of the back bearing ; the essential difference being a much larger frontal area, since in this case the wheelwork and its operating gear have to be accommodated on this rather limited space. An angle of 35 deg. struck from the uppermost 12-B.A. screw hole and projected for a distance of $2\frac{5}{8}$ in. will give ample room, provided the gears are of fairly small diameter.

When cutting out the brass backplate and strengthening web it will be noticed that the height of the latter is less than that of the back bearing ; were this not so, there would be insufficient side clearance for balance control spring. One other important point is, that the baseplate is positioned with the anchorage screw holes facing backwards. By this means, a maxi-

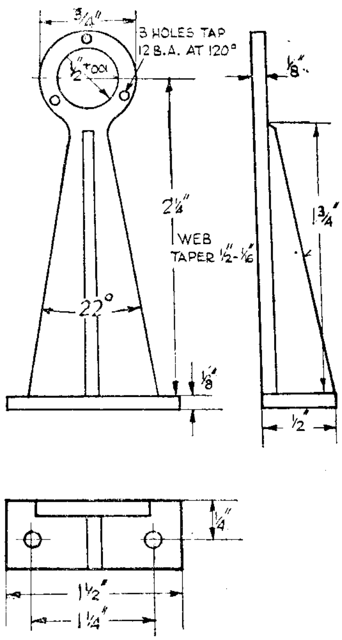


Fig. 13. *Bearing pedestal (back), 1 off, brass*

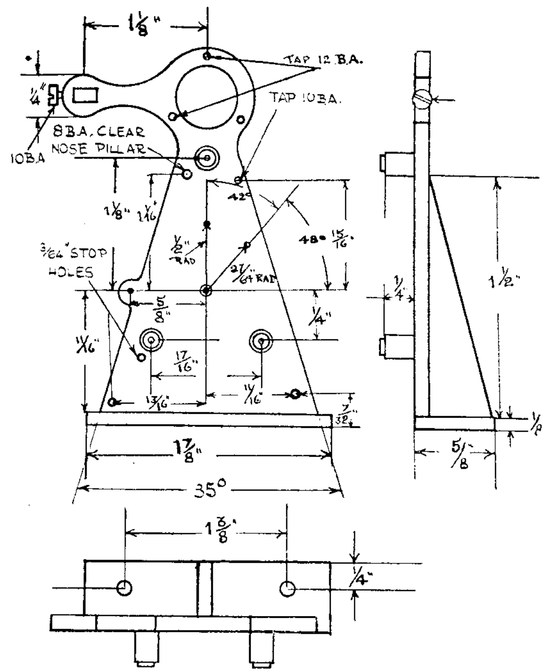


Fig. 14. Bearing pedestal (front)

mum limit of area is available at the front for accommodating the dial propulsion mechanism.

Neatly drill and file out the rectangular hole, accommodating control spring anchorage stud, also drill and tap the lug for a 8-B.A. clamping screw as shown. Pin and solder as in Fig. 13, but with a strengthening web at back.

When the job is cleaned and edges polished, proceed to mark off the gear pitch circles as follows :—

(*a*) Measure a distance of $\frac{11}{16}$ in. from upper surface of base and drill a 1/32-in. hole dead on the centre line, but do not extend it completely through the web—about $\frac{1}{8}$ in. deep will be sufficient.

(*b*) From the centre hole, already drilled, strike a line upwards at an angle of exactly 48 deg. From the same centre scribe an arc of 27/64 in. radius cutting the above line. The point of intersection should be accurately marked by a 1/64-in. drill point.

(*c*) Scribe another arc from the same centre of exactly $\frac{1}{2}$ in., to cut the centre line at 42 deg., again marking intersecting point as above.

(*d*) Drill three holes accommodating plate supporting columns which are 3/32 in. diameter.

(*e*) Drill the two pivot holes, previously marked, accurately with a 1/64-in. drill, slightly countersinking from the back ; also drill rocker pivot hole.

General Remarks

The gear pitches described above are to suit the following wheels taken from a large Ansonia-made Ingersoll watch :—

(i) Centre wheel, 60 teeth and 19.5 mm. diameter (outside).

(ii) Intermediate wheel, 56 teeth and 17.5 mm. diameter. Pinion of eight leaves.

(iii) Propelled ratchet wheel, 30 teeth about 17 mm. diameter. Pinion of seven leaves.

The train therefore equals $\frac{7.5}{1} \times \frac{8}{1} = \frac{60}{1}$ and since there are 30 teeth on ratchet wheel the rotation is obviously one revolution per minute. It will be noticed that the arbor of this wheel is located in a central position and can be extended through the front plate, if desired, to operate a seconds hand.

The ratchet wheel, or, in fact, the complete set of gears, can be cut very cheaply by any Clerkenwell firm specialising in gear-cutting. I mentioned the fact of utilising discarded watch wheels because it is necessary with this design to incorporate a rather flat train made so by limited lateral space ; the gears first mentioned being admirable for the purpose. The three plate supporting columns are also procured from the same Ingersoll movement.

(To be continued)

An Automatic Traverse Cut-out

by A. R. Turpin

WHEN turning long shafts using a slow automatic feed, it is very tedious having to stand by the lathe and watch the toolpost wend its weary way along the bed ; but if the lathe is allowed to look after itself for a while, whilst a more interesting job is done, it is certain that sooner or later the tool will be allowed to overrun the correct traverse, with dire results to either the work, or the lathe.

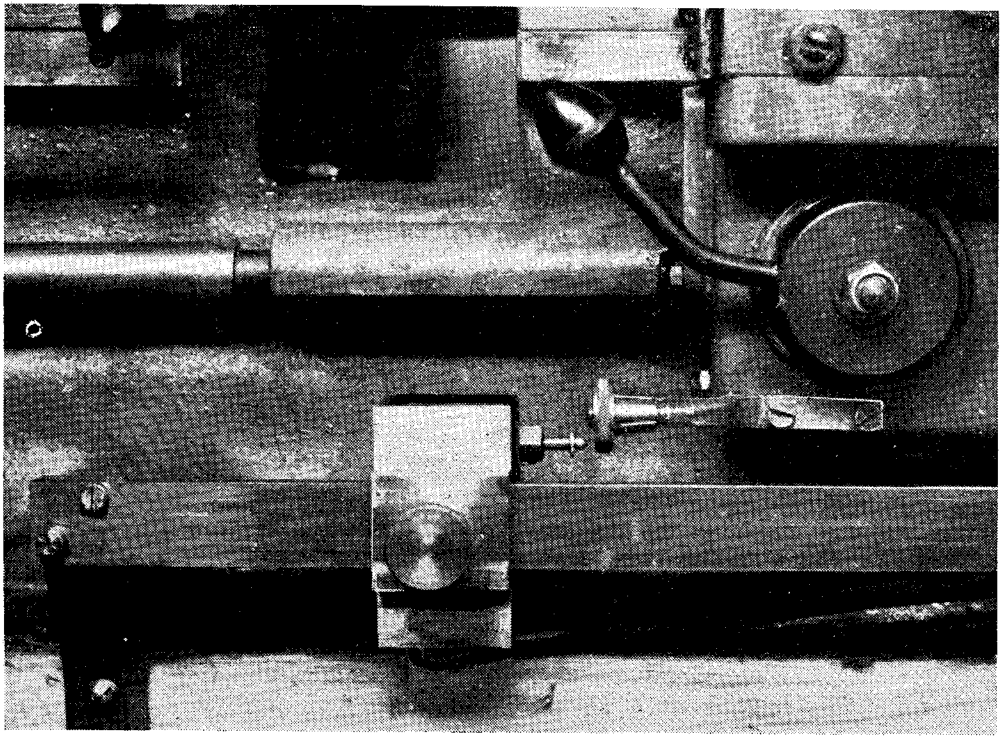


Photo showing the cut-out in use on an M.L.7 lathe

With my old $3\frac{1}{2}$ in. Drummond, a mechanical traverse cut-out could be set to obviate accidents like this, and so I decided to try to fix up a similar arrangement on my M.L.7.

It was decided that an electrical cut-out would be the simplest arrangement, and having picked up a micro-switch at a " surplus " store for a few pence, it was immediately used for the job, as shown in the photograph and Fig. 1.

The arrangement consists of the micro-switch, wired in series with the main switch, and mounted on a brass bracket that is free to slide along a $\frac{3}{4}$ in. $\times$ $\frac{5}{16}$ in. mild-steel bar, the latter positioned in front of, and slightly below the bottom of the lathe apron. The switch bracket can be clamped in any position by the finger-screw on the front.

Fixed to the apron by two 2-B.A. screws is a short length of $\frac{1}{4}$ in. diameter mild-steel rod screwed $\frac{1}{4}$ in. B.S.F. at one end, and flattened and drilled for the two B.A. screws at the other. A finger-nut with a split skirt is screwed on to the threaded end. As the carriage reaches the end of the desired length of travel, the front of the finger-nut comes in contact with, and depresses the plunger of the micro-switch, which stops the motor. The reason for the finger-nut is that this allows a finer adjustment of the cut-out position than is possible by the use of the sliding switch alone.

In the photograph it will be seen that the slide bar is held in position by two vertical brackets screwed to the edge of the bench, and for those readers who possess the Myford steel stand, it is suggested that these brackets be bent at right-angles, and fixed under the heads of the lathe holding-down bolts.

It will be found that when the split-nut

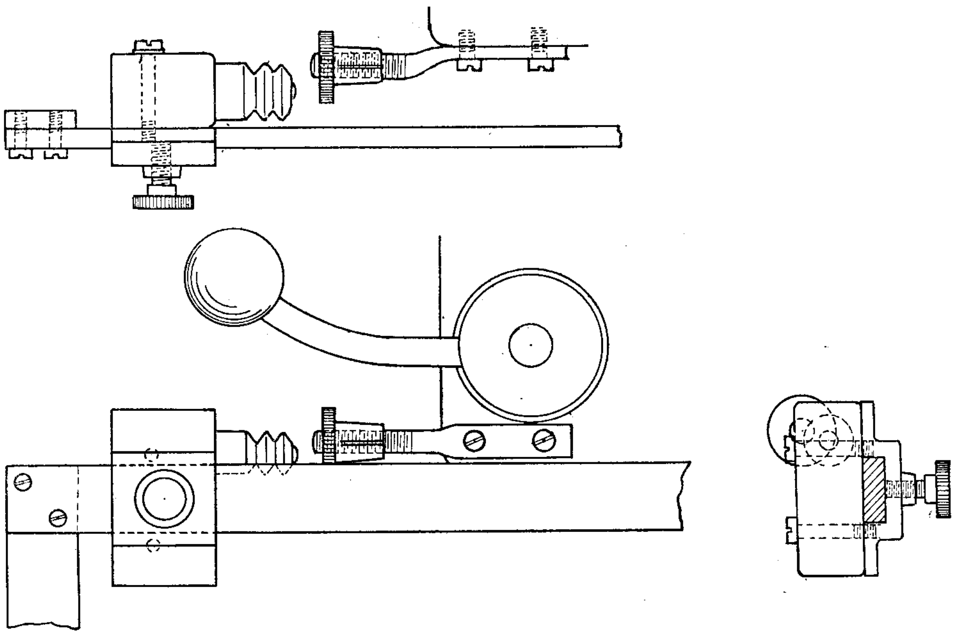


Fig. 1. The automatic traverse cut-out

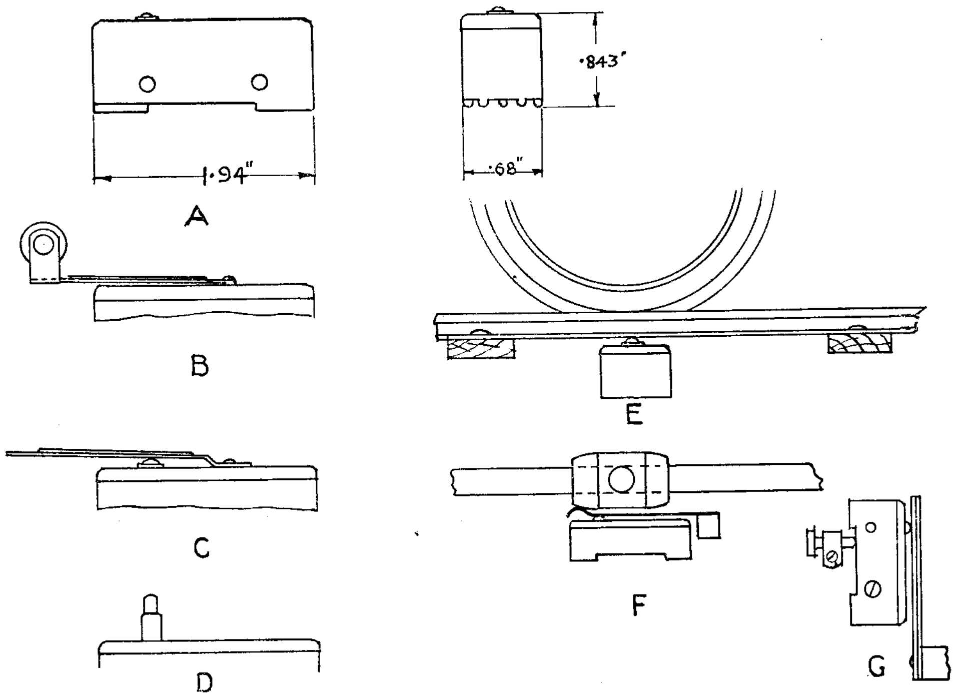


Fig. 2. Various types of micro-switches and suggested uses

actuating lever is depressed, it will foul the switch, and it is therefore necessary to bend up this lever as shown in the photograph.

Although these micro-switches are capable of operating within 0.00025 in. of the set position, it is not possible to utilise this accuracy to the full, owing to the "overrun" caused by the inertia of the lathe, and this "overrun" may vary from .1 to 3 revolutions of the chuck, depending on the speed of the mandrel, the feed, and the depth of cut; but a few trials will enable the user to judge the amount to allow when positioning the switch very accurately, and for blind boring it will be found to be a blessing, indeed.

It will be noticed that the micro-switch shown in the drawing differs from that shown in the photograph; the drawing shows the latest Burgess switch specially designed for machine-tool work. The "on" and "off" differential movement of this switch is 2 to 3 thous. in., it has a free movement of 0.024 in., and an over travel of 0.187 in., and is completely oil and moisture proof.

These switches work more or less on the same principle as those clickers used by lantern lecturers, and although the operating movement of the plunger is only from 1 to 3 thous.—depending on the type of switch—the movement of the actual switch contacts is quite large. The rating is 5 A, at 250 V, and they may be used for a.c. motor control up to ½ h.p.

The model engineer is likely to find a number of uses for this type of switch. A number of different types are made, and one very useful basic type is shown at *A*, Fig. 2. This switch requires an operating pressure of 14 oz., and has an operating differential of 0.001 in., and an over travel of 7 thous. The contacts may be arranged as single-throw, normally open; single-throw, normally closed and double-throw. This basic switch can be obtained with various types of operating levers, as shown at *B,C,* & *D*, and a special switch is available incorporating a trip that holds the switch open or closed until manually released.

Three uses for such a switch are shown at *G,E,F* Fig. 2. At *E*, the switch is operated by the flexing of the rail as a model locomotive passes over it. At *F*, an alternative method of actuating the traverse cut-out is shown; and at *G*. a simple thermostat, a bimetal strip being used to operate the switch. Countless other uses suggest themselves, such as steam pressure and water-level warning indicators, counters, timers, and foot operated switches, etc.

These switches may be obtained from Messrs. Burgess Products Ltd., Sapcote, Leicestershire.

PRACTICAL LETTERS

International Racing!

DEAR SIR,—I feel I must write regarding Mr. Stone's article *re* the Swiss International Regatta. First of all, why call it International? I should hardly call it so, with engines that were mostly obtained from one country, put in hulls and called entries from Britain, or France, or anywhere else. To be international, the boat should in my opinion, be designed and built in the country of the competitor, and when I say that, I mean designed and built by the person entering it. After all, I do not see why anyone with the cash and contacts should be able to buy an engine, put it in a box, run it and say it is "all my own work." I should be more inclined to say, "Well done, Doolings, for producing such a good engine." For the builder deserves the credit for the performance of his products, and with most of the boats powered by engines from the same country, there is as much flavour of international competition as there is of lavender from a kipper-box!

Personally, I should like to see his boats doing the knots just for the pleasure of seeing a boat doing it; but, honestly, I should not give Mr. Stone, or anyone else for that matter, the credit for it. My opinion is that a man at home in his little "chicken-shed" workshop, who designs, builds and develops a power-plant and boat, is far more entitled to credit and reward than someone who buys a ready-made job and runs it against the other fellow, irrespective of the speeds obtained.

Regarding the unsuitability of Victoria Park for running boats of the "fast" type, I cannot see why Mr. Stone comes to his decision, because when you design a boat you design it on a compromise basis, to suit all the types of water you are likely to run on; unless, of course, Mr. Stone is in the position to say that he wants all regattas to be run on the lake he designed his boat for. After all, he is in his element when the other fellow has to come to his type of lake, just as it is the other way round; and as to his not being able to stay on top of the water in the International, how was it he was even allowed to run at all in this event? If the M.P.B.A. ruling allows for someone to buy an engine and build a boat or the other way round, I think that for an event of international importance, the rule should be altered immediately, so that the whole issue should be designed and built by the person who enters the boat for competition. "International" implies that a fellow from one country should pit his brains against a person from another country; only in this way is it possible to get true international competition.

Finally, if Mr. Stone were to design and build an engine and boat of his own, and not bask in the reflected glory of someone else's products, I think that it would be a long time before he would touch the *slow* speed of 50 m.p.h., and he would be quite capable of running on any lake, *Victoria Park* included, for a long while to come; that would be one cure for the trouble he is getting now, *viz* — High-speed dives.

Yours faithfully,

Finchley, N.3. E. G. CLARK.

The "International" Winner

DEAR SIR,—I am sure all power boat enthusiasts will wish to congratulate Mr. B. Miles on his very fine performance in winning the "International" this year with a speed of over 53 m.p.h.

From the brief description, it appears that this boat is of unique design, and therefore, of unusual interest to power boat men. I wonder if Mr. Miles could be persuaded to submit a description of his boat to you for publication in THE MODEL ENGINEER.

I think it is particularly pleasing to model engineers that the best performances are still being put up by free-lance home built engines, in spite of all the "hot" commercial engines on the market.

Yours faithfully,
Glasgow. D. C. JEFFREY.

Feed Pump Design

DEAR SIR,—I have read with interest and pleasure the very lucid and readable articles on Utility Steam Engines and Boilers by Mr. Westbury, the latest being in the October 8th issue, in which the question of pump capacity is discussed. Mr. Westbury rightly states that it is very difficult to assess the steaming capacity of a boiler and therefore the amount of water required to make up that lost by evaporation in the boiler and consequently the capacity of the pumps required or in other words its bore and stroke. May I suggest that this is the wrong approach to the problem and that one should begin with the cubic capacity of the engine and the pressure of steam at which it is intended to run the engine? For example, if the bore is $\frac{3}{4}$ in. and the stroke $\frac{3}{4}$ in. and the engine is a double acting slide valve one, and the boiler pressure, say 60 lb. per sq. in., then by a physical formula it is possible to calculate exactly the requirements of the pump. The cubic capacity of the engine is easily calculated and to make one revolution, the cylinder has to be filled twice, therefore: $2\pi r^2 \times L$ equals the volume of steam at 60 lb. Where r = radius of cylinder and L = stroke. Now if this volume of steam at 60 lb. is reduced to normal temperature and pressure, i.e. from 60 lb. at the temperature of steam at that pressure, and then converted to cubic centimetres we have a figure on which a very definite calculation can be made. It is known from physical science that the molecular weight of any substance in gaseous form occupies a volume of 22,400 c.c. at normal temperatue and pressure, and in the case of water as one gramme occupies a volume of 1 c.c. in liquid form; it follows that its molecular weight occupies a volume of 18 c.c. (H_2O = 2 grammes H and 16 grammes O_2) and this evaporated at normal temperature and pressure would give a volume of steam of 22,400 c.c. Now for the sake of argument (for I have not worked out the example of the engine already quoted), if the volume of steam at N.P.T. for a complete revolution is, say 400 c.c., then the capacity of the pump required for all engine speeds (assuming boiler pressure is more or less constant at 60 lb.) is $\frac{400}{22{,}400} \times 18 = 0.33$ c.c. roughly.

This can easily be converted to cubic inches and once this is determined one can easily find the stroke of the pump for a given diameter. On this principle I designed a boiler feed pump for a 3 ft. 6 in. steam yacht and to make allowance for possible gland leakages etc., added about 10 per cent. to the pump capacity and as a compensation for this amount a bypass valve.

In practice I have steamed this little vessel for hours on end at all speeds within engine range and hardly ever had to give any attention to pump adjustment and the boiler level remained constant

By way of definition, it may be noted that "normal temperature" means zero on the absolute scale, i.e. -273 deg. F., and "normal pressure," 760 mm. of mercury.

I hope these notes will assist in simplifying the problem of pump capacity in steam power units.

Yours faithfully,
Colne, Lancs. T. FLETCHER, M.B., Ch.B.

(Dr. Fletcher's contention is, of course, quite correct in cases where all the conditions under which the engine is to be worked, and the rate at which the boiler is to be steamed can be predetermined. In cases where engine speed is varied by throttling or linking up, it is possible to keep the pump output and the steam consumption more or less in proportion, but Mr. Westbury refers particularly to variation of speed brought about by increase or decrease of load, and under these circumstances, steam consumption may be the same under widely differing engine speeds. If pump output is definitely tied to engine speed, either by direct-coupling the pump, or driving it by reduction gear, the boiler will then be fed at too great a rate when running fast on light load, and at an insufficient rate when running slow under heavy load. The conclusions arrived at by Mr. Westbury, therefore, hold good for engines which may be run under variable or indeterminate load and speed conditions.—EDITOR, M.E.)

Modern Locomotive Design

DEAR SIR,—It is a somewhat risky thing to criticise Editorial pronouncements; nevertheless, I feel that your reference to Mr. O. V. S. Bulleid in a recent issue calls for comment.

I would say personally that *all* locomotive enthusiasts with a reasonable knowledge of mechanical engineering can only view Mr. Bulleid's retirement as a sad blow to British locomotive designing.

It is a curious fact that the very people who vaunt their contempt for convention and orthodoxy are the first to ridicule any departure from it; the childish epithets hurled at Mr. Bulleid's productions are an excellent example. I have had the good fortune to have been able to examine a lot of Mr. Bulleid's work at close quarters and I have conceived the greatest admiration for it.

For 100 years the steam locomotive has settled down along stereotyped lines, and, in passing, any departure from such lines has been greeted with derision from the school of thought which appears to believe that progress in locomotive design ceased with Stroudley, the Stirlings and the Kirtleys.

Mr. Bulleid has brought to bear on loco. design a singularly clear and unbiased mind;

he has quite obviously considered the question in the light of a pure mechanical engineering problem, divested of the trammels of convention. He has set out not only to improve thermal efficiency, but, far more important, availability, and maintenance costs.

To quote a paragraph from an excellent leading article in a recent issue of *The Railway Gazette* :

"But, whatever the policy of the Railway Executive may be, Mr. Bulleid's work will have given the steam locomotive a new lease of life and will have a profound influence on locomotive designers throughout the world."

So far as thinking engineers and locomotive enthusiasts are concerned, there can be no "mixed feelings" over Mr. Bulleid's resignation, but only a profound regret. England's loss is Eire's gain. The steam locomotive, whether we like it or not (and I hate the idea) is on the way out; it may last a long time, but the writing is on the wall for all to see who are not wilfully blind. Mr. Bulleid's work is likely to do much to defer that sad day, and for this alone the gratitude of all loco enthusiasts should go out to him.

Yours faithfully,

Wealdstone. K. N. HARRIS.

CLUB ANNOUNCEMENTS

Romford Model Engineering Club

On Sunday, October 9th, a party of thirty-seven members and friends visited Mr. S. Stuttle's track at Hullbridge. A pleasant day was spent on the track which runs round the half-acre garden, the River Crouch forming a counter attraction, being only a few yards away with its numerous sailing and motor cruisers. The main party travelled by coach, taking with them seven locomotives which were conveyed without damage in the luggage compartment at the back of the vehicle. This seems to be the ideal means of transportation for club locomotives, for although we loaded our engines with some misgivings, we were pleasantly surprised to find them quite unharmed at the end of the journey.

On Thursday, November 17th, Mr. T. J. Holder will give us a talk "Reminiscences of an Amateur Engineman." The meeting will be held at the Lambourne Hall, Western Road, and will commence at 8 p.m.

Hon. Secretary: C. WILKINS, The Lodge, Woodward Road, Dagenham. Tel.: Rippleway 2871.

Radio Controlled Models Society, London Group

It was agreed at a recent meeting that the group should endeavour to make a separate transmitting outfit for the DUKW, similar to that loaned by Mr. Cummins. Complete drawings can be supplied, and all the components. Any member who can help in any way—i.e., fabricating chassis and cases, wiring, etc.—please notify the secretary. Mr. Cummins will undertake the final lining up and tuning.

London Group Secretary: G. C. CHAPMAN, Lieutenant (L) R.N., Pine Corner, Heathfield, Sussex.

Barnoldswick and District Model Engineers' Society

At our meeting on Friday, October 28th, 1949, the model tug *Chieftan*, made by one of our members, Dr. T. Fletcher, of Colne, was on view. This model was awarded the Championship Cup in its class at the recent MODEL ENGINEER Exhibition and a fine photograph of it appeared on the cover of THE MODEL ENGINEER dated October 13th, 1949.

Dr. Fletcher gave a very able and lucid description of the model, for which he was heartily thanked.

Hon. Secretary: A. BERRIDGE, The Orchard, Coates, Barnoldswick, Via Colne.

Salisbury and District Model Engineer Society

We have been fortunate in securing, with the goodwill of the headmaster, the part use of excellent accommodation in the Palace Hut (*ex*-Y.W.C.A.) in the grounds of the Cathedral School, The Close, at a very reasonable rent.

All future meetings will be held there on the usual Monday and Friday evenings from 7.30 to 10 p.m. The ladies' section will also meet there on Tuesday evenings.

A programme of events for the winter is being arranged; dates of some are given below—and we hope that with our improved facilities we shall attract many new members.

Monday, November 21st, 7.30 p.m. Demonstration by Mr. G. D. Lovell on "Silver-soldering Without Gas or Blowlamp."

Monday, December 5th and Monday, December 19th. Talks to be arranged.

Monday, January 30th, 1950. Provisional date for film show by "1066" Products Ltd. on the production of the "Conqueror" engine, "Foundry to the Track," and films taken at various race car meetings.

It is proposed to hold "round-the-pole" flying contests this winter at the Palace Hut (rubber-driven models), so get building, aeromodellers!

It may also be possible to hold model car racing or trials in the hut, though not for high-powered cars.

Hon. Secretary: R. A. READ, 7, De Vaux Place, Salisbury.

Cambridge and District Model Engineering Society

The above society are holding their second model exhibition in the Co-operative Hall, Cambridge, until Saturday, November 19th.

We have recently secured permission from the Town Council to use the bathing pool on the Lammas Green for members to sail their model boats. This is a great concession and has overcome one of the difficulties we have been faced with in providing these facilities for the "boat" members of the society.

The outdoor rail track which has been built on land loaned to us free of charge by the president is almost completed and we are now awaiting a suitable date for its official opening.

In appreciation of the facilities granted to us by the Borough Council in providing workshops, etc., free of charge, two prizes were given by the society to scholars in the Chesterton Senior Boys' School for the best models in metal and woodwork. These were not only appreciated by the scholars but by the Council, headmaster and boys.

The President has provided a cup, and other gentlemen prizes for competition at the exhibition and we are deeply indebted to all concerned for the practical interest in the work of the society.

Hon. Secretary: J. W. ATKIN, 16, Ross Street, Cambridge.

Birmingham Society of Model Engineers

Fortnightly meetings have been resumed by the Birmingham society at 7.30 p.m. at the White Horse, Congreve Street, Birmingham, the last being held on November 9th, when Mr. H. Brenholz gave a talk on "Full-size Railway Signalling."

Hon. Secretary: WILF. H. KESTERTON, 31, Wood Green Road, Quinton, Birmingham, 32.

Harrow and Wembley Society of Model Engineer

On Wednesday, October 26th, two club members spoke to a well attended meeting of the above society at Heathfield School, College Road, Harrow. First Mr. E. V. Elderkin spoke about clock movements of various kinds, then Mr. C. R. Fox gave members some hints on free-lance locomotive design. After questions, the meeting finished with a discussion.

Hon. Secretary: J. H. SUMMERS, 34, Hillside Gardens, Northwood, Middx.

NOTICES

The Editor invites correspondence and original contributions on all small power engineering and electrical subjects. **All such correspondence should be addressed to the Editor (and not to individuals)** at 23, Great Queen Street, London, W.C.2. Matter intended for publication should be clearly written, and should invariably bear the sender's name and address.

Readers desiring to see the Editor personally can only do so by making an appointment in advance.

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